

# **SPRINGS OF TEXAS**

**GUNNAR BRUNE**

*VOLUME I*  
**PART 4**



**BRANCH-SMITH, INC.**  
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there was once constantly running water here. There is still seepage from Whitehorse sandstone and gypsum in Hackberry Creek at Highway 70, 11 kilometers south-southwest of Teepee City.

In the 1860s and before, an Indian village existed at Teepee City. In the 1870s a wagon train of settlers and traders from Dodge City crossed the "running stream by a cottonwood tree." Some stayed on, establishing a trading post and buffalo hunters' camp which used the water. Cottonwood and salt cedar trees and plum thickets indicate that the water table is still shallow. The channels have now been largely filled with sand from modern erosion.

**Scab 8 Springs (13)** were 22 kilometers east of Matador on Highway 70, on O. J. Barron's Tongue River ranch, managed by Taylor Martin. They issued from Cloud Chief gypsum which dips toward the west. According to Martin, the flow filled a  $\frac{3}{4}$ -inch (1.9-centimeter) pipe, and could water 1,000 head of cattle at the old Scab 8 ranch headquarters. The springs have been dry since about 1945. An old windmill still stands here, amid cottonwood, hackberry, and chinaberry trees. Many other similar springs formerly flowed in this area. The Tongue River, six kilometers east, into which the springs once flowed, was also dry on July 13, 1979.

Five kilometers south of the town of that name are **Roaring Springs (1)**, widely known as a natural beauty spot. In 1877 they were also known as **Jessamine Springs**. They emerge at an elevation of 765 meters and fall over the sandstone ledge below the springs. In 1876 when buffalo hunters camped at the springs they could hear the roar of the falls more than 1.6 kilometers away. Now it cannot be heard 0.4 kilometer away. This may indicate a decline in the spring flow, which many local residents say has occurred. However, in the last 40 years or so very little decline is evident.

The recharge area for Roaring Springs is on the High Plains 20 or more kilometers to the west. Here rainfall slowly seeps down through the Ogallala sand into the Dockum sandstone, in which it travels to the springs. Because of the heavy pumping for irrigation on the plains, water is being removed much faster than it can be replaced by recharge. But because of the slow movement of water through the formations and the distance of the springs from the recharge area, the effect of the declining water table on the plains may not reach the springs for some years. Discharge records in liters

per second by water years are as follows:

1937	31	1960	31
1938	31	1961	40
1939	31	1962	42
1943	31	1963	40
1944	34	1964	40
1945	57	1965	34
1946	71	1966	28
1947	57	1967	25
1948	40	1968	34
1949	40	1969	37
1950	37	1970	31
1951	37	1971	37
1952	42	1972	37
1953	40	1973	37
1954	40	1974	37
1955	40	1975	28
1956	40	1976	31
1957	34	1977	37
1958	40	1978	40
1959	37		

Part of Coronado's army may have camped here in 1541. When the buffalo hunters arrived in the 1870s, they found the poles of Comanche tepees still standing at Roaring Springs, probably abandoned a year or two earlier. In fact this was the main camp of the Comanches in 1860.

Later the springs became a very popular oasis for the white settlers, who held many camp meetings and picnics there. Maidenhair ferns cover the rocks and water cress thrives in the streams, shaded by walnut trees. The water supplies a swimming pool and recreational area. (See Plate 6, a). In 1978 the springs and their surroundings were bought by Jarrell Jennings, who converted them into a recreational vehicle campsite. A historical monument is near the springs.

**Wolf Springs (2)**, about 12 kilometers southwest of the town of Roaring Springs, at latitude 33°52' and longitude 100°59', are the source of Wolf Creek. Along Wolf Creek a large amount of groundwater moves through the sand just below the stream bed. The surface flow is a relatively small part of the total. These springs are difficult to reach, over private ranch roads. The surrounding area is a good example of the destruction of the natural flora by overgrazing. There are miles and miles of mesquite, cactus, yucca, and weeds, with very little grass remaining. Following are the available discharge measurements, in lps:

Sep. 13, 1938	1.9	Jan. 22, 1969	13
Jan. 22, 1969	2.5	Jun. 16, 1975	7.1

The last two discharge measurements were made one kilometer downstream and include several other springs.

**Dutchman Springs (9)** are on Dutchman Creek 10 kilometers west-northwest of the town of Roaring Springs, on Curtis Martin's ranch. On July 11, 1979,



there was a discharge of 2.3 lps at the ranch house from Ogallala sand on Triassic shale. The creek channel has been completely filled with sand from severe gully erosion. Frogs, minnows, quails, doves, and other birds make their home among the cattails and rushes. Huge cottonwood and willow trees, plum bushes, and grapevines shade the water.

Dutchman Springs formerly originated three kilometers upstream (west) on Harold Campbell's ranch. According to Campbell, the creek flowed here constantly until about 1905. It flowed intermittently until around 1935. There are still a few pools in winter here, but no running water.

#### NACOGDOCHES COUNTY

Most of Nacogdoches County's springs flow from Tertiary Eocene sands, ranging from the Wilcox up to the Yegua formation. The most abundant water-bearing sands are the Wilcox and Carrizo in the northeastern part of the county. These formations dip to the south at about 10 meters per kilometer. Some springs also issue from Quaternary sand and gravel terraces along the major rivers.

The springs were used for many millenia by early Americans. Just before the dawn of history in the area, an agricultural mound-building people lived here. When the Spaniard Domingo Ramon arrived in 1716 he found the people of the Hasinai or Tejas confederacy living in *rancherias* or villages near the springs, and cultivating many fields of corn, melons, beans, and tobacco. These people were light-skinned and fair-haired, leading some to believe that they were descended from European explorers of an earlier age, perhaps as early as the eighth century.

Virgin forests once covered the area. Their canopies were so dense that little light could penetrate. Hence there was very little undergrowth, and travel through most of the forests was relatively easy. Clearing and plowing caused severe erosion, the scars of which can still be seen in the form of gullies in second-growth woods. Sediment from this erosion covered many former springs.

Springs are numerous in this area, and only those having some importance for historical or other reasons have been included. Nevertheless, water tables have declined, especially near the cities, because of well pumping, flowing wells, and other causes. As a result the springs are no longer as large or as numerous as they once were.

The water is normally of a sodium bicarbonate type, soft and acid. It is usually fresh, but some mineral

springs occur. The content of iron, silica, or sulfate may be high.

Most of the writer's field studies were made during the period February 9 - 15, 1978. As this period was immediately preceded by an ice storm and much rain, the observed spring discharges are probably higher than normal for this season.

One of the most important groups of springs in the county are those which furnished water for the mission Nuestra Senora de Guadalupe (1), beginning in 1716. In 1978 they still flowed 0.33 liter per second from Weches sand at the foot of Baxter Duncan Street in Nacogdoches, draining into *Banito* or Little Bath Creek. The mission is believed to have stood some 350 meters northeast on the bluff between Muller and Powers Streets. Very likely the springs extended to the base of the bluff 150 meters from the mission in those days, when the water table was considerably higher. Some time before the mission was abandoned in 1773, the springs were probably replaced by a well as a water source. The mounds which have been found along Mound Street 800 meters east of the springs indicate that people lived here long before the missionaries arrived.

On the other side of the ridge on which Nacogdoches now stands, near *La Nana* (The Nanny) Creek, were **Los Ojos de Padre Margil** or The Springs of Father Margil (2). During the great drought of 1717 - 1718, when Banito and La Nana Creeks dried up, Father Margil struck the soft red rock three times, and the two springs began to flow again. The actual cause of the revival of the springs was undoubtedly rainfall on the outcrop of Weches sand to the north, recharging the aquifer. The springs were described in 1828 by Jose Maria Sanchez as follows:

On the west bank of La Nana, there are a few boulders from which two small springs of cold and clear water flow and keep two circular basins of about half a vara in diameter and a little less in depth always full.

The location was near the foot of Ernie Street, according to Mrs. Roger Montgomery and Mrs. Branch Patton, historians of Nacogdoches. In recent years La Nana Creek has been straightened and moved eastward away from the springs. The old channel has partially filled with sediment and this fact, together with a falling water table, has caused the springs to dry up, except for a few seeps. By the time this book is published there should be a historical marker regarding the springs nearby.

In northwest Nacogdoches, on Spring Creek, are the **Waterworks Springs (12)**. The many springs rise at an elevation of about 100 meters from Sparta sand. The fresh water flows through the pond at Mill Pond Park and down to Banito Creek. In 1914, when they were the city's water supply, Deussen reported the discharge to be 13 lps. On February 13, 1978, it was about the same, but some surface runoff was included.

Ten kilometers south of Douglass the Spanish mission Nuestra Señora de la Purísima Concepción was established in 1716 at the village of the Hainais, the principal tribe of the Hasinai. In the words of Father Espinosa, who accompanied the Ramon expedition (Tous, 1930b),

July 7, [1716] — Tuesday. I went with the Captain as far as two bubbling springs of water which do not seem large enough to supply the people of this village. The Captain gave me possession in the name of His Majesty as is customary. He then, with the Fathers of Zacatecas went to establish their mission. Meanwhile my two companions and I changed our belongings to the spring of water.

Just south of the mission site, which is indicated by a historical marker, an iron-bearing spring (11) flowed 0.55 lps in 1978 from Weches sandstone and sand on Catherine Hunter's property. Undoubtedly many other springs flowed near the mission in 1716. Probably no well was dug until later. Mrs. Pauline West Mund, a nearby neighbor, states that many springs in the area have failed in the last 30 years. Immediately west of the mission site, in 1837, John Durst founded the town of Mt. Sterling with wharves on the Angelina River. In Blake's words (1953), his palatial home was erected near

a beautiful spring [Cedar Spring] which still flows, as clear as crystal, from the red rock.

About two kilometers north of the mission site is a historical marker commemorating the presidio where Spanish soldiers were stationed to guard the mission. In 1781 Fray Juan Agustín de Morfi, on an inspection tour of Spanish missions, wrote of this site:

*Laguna del Presidio.* A short distance beyond, after passing some hills and ravines similarly covered with trees, are the plains where the presidio de los Texas, established in 1716, was built. It was near a lake of fresh water formed by a spring in its center.

Here, on Tommy Yates' farm, several small springs (10), probably those referred to, flow from Weches

sand, but the lake is gone. The early occupants of the Yates house, which dates from 1865, also depended on these springs.

At the E. V. Rector place in Douglass was an old stage stop and hotel. In its early days some small springs (9) from Queen City sand at the base of the bluff to the northwest were probably vital. A large Hasinai village which once extended from here west to the Angelina River also used these and neighboring springs.

**Sacul Springs (8)** are on the southeast side of Sacul on Dick King's property. In 1788 the Spaniards Pedro Vial and Francisco Fragosó probably stopped here. They described a "beautiful spring of water that is called **El Lucero** [the Bright Star]," three leagues west of the Nadaco Indian village (Loomis and Nasatir, 1967). Later the springs supplied water for a sawmill and for the railroad's steam engines. On September 8, 1936, they discharged 0.50 lps and on February 12, 1978 only 0.07. They issue from Quaternary sand at an elevation of 85 meters. The remains of an old rotted-out wooden box may still be seen at the site.

About four kilometers northeast of Cushing near Dill Creek, on Dr. Tom Williamson's property, is the probable site of the mission San José de los Nazones, marked by a monument. Small soft-water springs (21) from Carrizo sand were noted here by Deussen in 1914. They were much used by the Nasonis and probably by the mission in its early days, starting in 1716. An old Indian road crossed the creek here. The springs are now apparently only seeps. Some writers believe that the Nasoni village and the mission were some six kilometers farther east, at the confluence of Beech Creek and the East Fork of the Angelina River. Stronger springs from Carrizo sand occur here.

Seven kilometers south-southeast of Trawick, on M. L. Gray's farm, are **Rock Springs (5)**. Many Indian artifacts found here, including metates, manos, and projectile points, indicate that this was a living area for an ancient people. In 1834 Rock Springs church was close to the springs and used the water. According to Gray, until the 1940s there were many more and stronger springs in the vicinity. An old road once passed the springs, which issue from Queen City sand. In 1978, 0.35 lps trickled from iron-bearing sandstone at the head of a small lake.

**Hall Springs (7)** are two kilometers north-northeast of Trawick, south of Linn Flat cemetery. The Hall Springs church, now two kilometers northwest, was formerly located here. In 1978, 0.35 lps ran from Carrizo sand.

**Caro Springs (6)** are at the ghost town of Caro, five kilometers east-southeast of Trawick, on J. L. Ded-

man's property. They once fed the boilers of the Whiteman-Decker Lumber Company. In 1978 they produced 0.54 lps of fresh water from Reklaw sand just east of the old sawmill. The rusting boilers are covered with vines and brush, and decomposed sawdust is becoming a black organic soil.

Eight kilometers northeast of Trawick are **Union Springs (3)**, near Union Springs church and cemetery. They trickled 0.07 lps from Carrizo sand in 1978, reportedly never failing. These and other nearby spring waters contain some oil.

**Tonkawa Springs (4)** are 10 kilometers west of Garrison at a former Boy Scout camp, now the Tucker estate. They once powered a gristmill at the Akers mill pond. They later supplied a swimming pool and other water requirements of Camp Tonkawa. The springs issue from Carrizo sand at the head of a steep ravine, at an elevation of 130 meters. Discharge records in lps include:

Mar. 31, 1942	14	Feb. 11, 1978	11
Dec. 4, 1968	13		

Rock walls and stairs have been built around the head of the springs. Large pines, holly, and cyrilla shade the fern- and moss-draped rocks.

Ten kilometers southwest of Garrison on Wayne Corley's ranch are **Corley Springs (22)**. The water, flowing from Carrizo sand, was formerly piped down the hill to Highway 59, where travelers slaked their thirst. On April 30, 1937 the discharge was 0.13 lps, and on February 15, 1978, after much rain, 0.24. A dead calf had bogged down in the wet sand surrounding the springs on the latter date. Water no longer flows from the brick spring box, but from other openings. Similar springs flow 1.5 kilometers west at Holly Springs cemetery.

The once famous **White and Red Springs (24)** are in Garrison. Many visitors formerly came to the hotel and bathed in and drank the water from both springs. White Springs are just west of the City Hall, near Elm Street and Avenue B. A large circular curb surrounds them, now largely covered with sediment. In 1978 0.06 lps still seeped from Carrizo sand. In addition to the chemical content of the water shown in the table of Selected Chemical Analyses, 7 milligrams of aluminum per liter are present.

Red Springs are 0.7 kilometer west-northwest of White Springs on Kenneth Barton's property. They formerly provided water to a school. According to N. C. "Red" Garrison, the red iron-bearing water was once bottled and sold as whiskey to train passengers during a brief midnight stop here. An old concrete wall and a

large cypress tree still stand at Red Springs, which discharged 0.24 lps in 1978.

The several **Cold Springs (23)** are now beneath Tinkle Lake, owned by D. W. Williams, just east of Cold Springs church and cemetery. They are said still to be flowing from Wilcox sand, producing good bass fishing in the lake.

**Stoker Mineral Spring (20)** was seven kilometers west-northwest of Martinsville, on A. T. Mast's property. In 1914, according to Deussen, the spring produced 0.16 lps and was a popular resort. According to Morg Stripling, a nearby resident, the water was used by Mt. Moriah church and by a sawmill. As shown in the table of Selected Chemical Analyses, the water was highly mineralized. It also contained 116 milligrams of aluminum per liter. The mineral spring was apparently destroyed or buried during logging operations. In 1978 fresh-water springs produced 0.68 lps at the site.

**Cove Springs (19)** are five kilometers east of Melrose, in a wooded draw just west of Cove Springs cemetery. Starting in 1851 large camp meetings were held here. Later 75 camp houses were built for those attending the meetings. The Cove Springs school also used the water. The springs in 1978 ran 1.2 lps from Sparta sand. Similar important springs emerge at the Spring Hill community seven kilometers northeast.

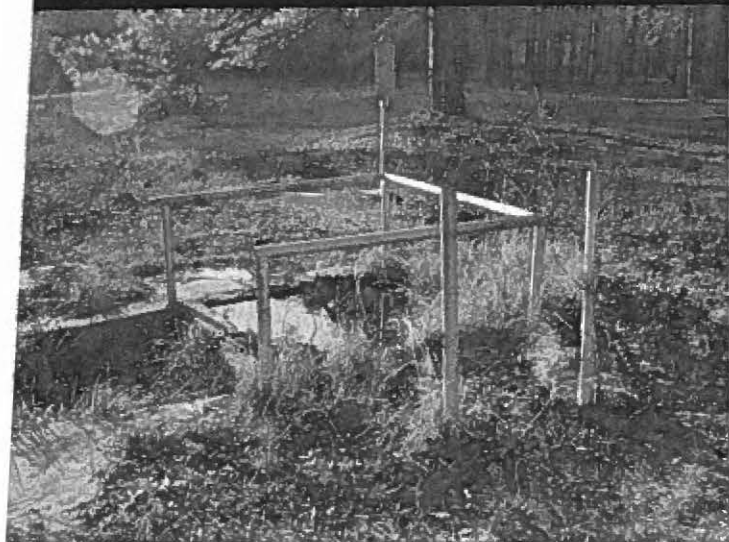
**Sulphur Springs (18)** are three kilometers west-southwest of Chireno. They were formerly visited in the summer by parties in feeble health, and were thought to produce great benefits after a few weeks' use. A sawmill also used the water. According to Mrs. Ira Palmer of Chireno, another spring nearby yielded oil which was used to lubricate wagon wheels.

**Clear Springs (17)** are in the Clear Springs community five kilometers southwest of Chireno. A church used the water until about 1928. Brush arbor meetings were held here until about 1943, according to Mrs. Elton Strickland of Chireno. In 1978 they poured 0.52 lps from Sparta sand. Peat moss, other mosses, and cloak ferns adorn the wooded site, which is frequented by blue herons.

**Blue Springs (16)** are five kilometers southeast of Etoile and just south of Blue Springs cemetery on Billy Sutton's property. According to Richard Whitehead, who guided the writer to the springs, oxen were once used to haul water from them to a gristmill and gin. A sawmill also used the water. Whitehead remembers the large trees of a virgin forest which surrounded the springs. The springs were boxed in, but hogs filled the box with mud. In 1978 they still produced 0.18 lps from Yegua sand amid much water pennywort.

**Oil Springs (15)** are in the ghost town of that name





*Oil Springs*

10 kilometers south of Melrose. Early Spanish explorers used the oil from these springs to lubricate cart wheels. Indians found the oil useful in healing insect bites, and perhaps in keeping insects off. Here in 1866 the first oil well west of the Mississippi River was drilled to a depth of 32 meters. In 1880 they were described as

a mineral or petroleum spring, very bold and having water of a peculiar taste, that is frequently resorted to in the summer by invalids, who are generally much benefited by a few weeks' stay and use of the water. . . . This spring yields quantities of crude petroleum oil, which is known to abound for miles around. It is thought that there is wealth in this mineral that will, some day, be developed.

The last statement was certainly true. Several oil springs flowed here. One was capped to keep the oil out of Rayburn Lake. Another, which may still be seen, was boxed in with concrete walls. This one, which seeps from Sparta sand, has a coating of oil on the water, but on February 14, 1978, did not overflow the box. A historical marker commemorates the springs in a pine woods park. Many frogs chirp in the pools.

**Shawnee Mineral Springs (14)** are 15 kilometers south of Nacogdoches on Southland Paper Company land. Located at latitude 31°28' and longitude 94°39' at the base of a bluff of Cook Mountain sandstone near the Angelina River, the springs can almost be reached with a 2-wheel-drive vehicle over a bad road. The mineral springs were evidently valued by the Indians, who left mounds nearby. According to Marion Tubbe, a nearby resident, many people used to camp at the springs, drinking and bathing in the water for as long as a year to improve their health. The analysis shown in the table of Selected Chemical Analyses was apparently one of the less mineralized springs, as it contained only 179 milligrams of dissolved solids per liter. In 1978, 2.9 lps poured from maroon sandstone draped with cloak ferns and moss. Beech and holly trees have been carved with numerous initials and

## NEWTON COUNTY

dates. One large beech has an 1887 date and initials more than three meters above the ground.

**Palisade Springs (13)** are 14 kilometers south-southwest of Nacogdoches and about 500 meters east of Highway 59, on Zeno Boehmer's ranch. They were a favorite camping place on Smuggler's Road, which some believe was laid out by the Frenchman Louis Juchereau de St. Denis in 1714 in order to avoid the Spanish authorities at Nacogdoches. Several springs, including one that is boxed in, produced a total of 1.1 lps from Sparta sand in this wooded area in 1978.

## NEWTON COUNTY

In protohistoric time the Atakapan Indians were living at the many springs in this easternmost county in Texas. Along the Sabine River they harvested oysters for their pearls and left large shell mounds. For a few decades after 1800 other tribes such as the Choctaws and Coushattas, displaced from their homes in the east, lived at Newton County's springs, especially around Biloxi.

The springs of the county issue chiefly from Tertiary and Quaternary sand formations, often called the Jasper, Evangeline, and Chicot aquifers in the subsurface. The large ones are in the northern section of the county, where the topography is hillier and therefore offers more favorable situations for springs. Water-level declines of as much as 65 meters have occurred as a result of heavy pumping in some areas. Also many flowing wells have been allowed to waste groundwater continuously. As a result a large number of springs have weakened or failed.

Most of the writer's field studies were made during the period January 10 - 15, 1976.

The spring waters are normally of a sodium bicarbonate type and are fresh, soft, and acid. In some cases the content of iron or silica may be high.

**Big Springs (2)**, ten kilometers west of Newton, are a little difficult to find. They are 200 meters east of the abandoned Big Springs cemetery, which has been almost obliterated by the growth of shrubs and trees. They were much used by early residents of the area in the 1850s. Of the several springs flowing from Willis sand, some are high in iron content and others are not. Many trilliums were preparing to bloom when the writer visited the springs in January, 1976. The springs can hardly be classed as *big* now, discharging 0.55 lps in 1976, although the name indicates that they were originally.

**Indian Springs (3)** are ten kilometers northwest of Burkeville, in the Indian Hill community. Flowing from

Willis sand at 1.3 lps in 1976 they were the reason that Atakapan bands lived here.

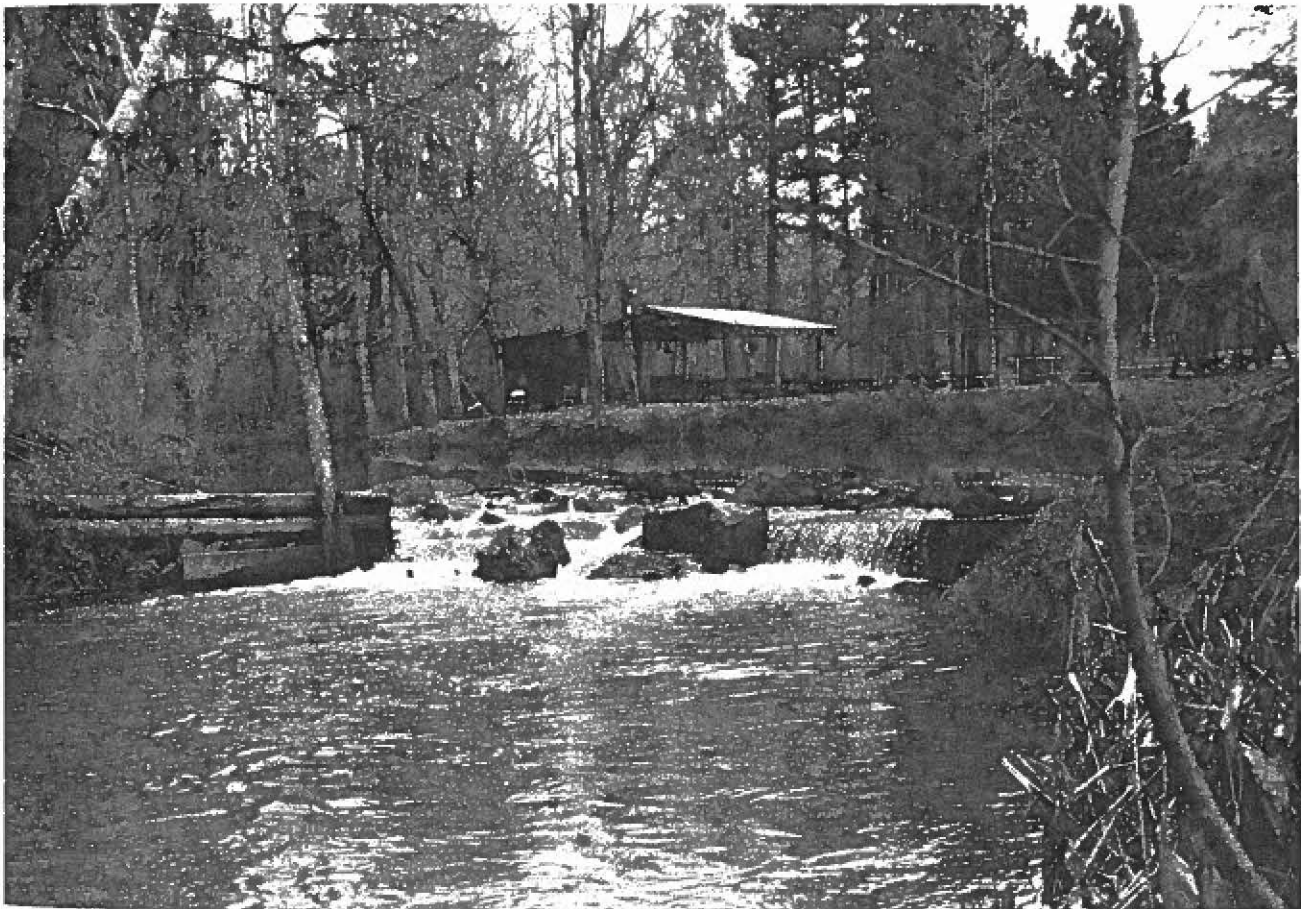
Seventeen kilometers north of Burkeville and 200 meters west of the Weaver Cemetery are **Weaver Springs (1)**. High in iron precipitate, they trickled 0.65 liter per second in 1976 from Catahoula sand. Eastern cattle drives in the early nineteenth century probably stopped here. The Weaver house across the highway is said to date from about 1845. Just south of the springs, on Watering Branch of Mill Creek, may be seen the remains of an old mill dam.

Twenty-three kilometers northeast of Burkeville in the northeast corner of the county are **Bevil Springs (4)**. Discharging 0.60 lps in 1976 from terrace sands on top of Fleming clay, the springs afforded a refreshing stop for travelers to and from the Bevil or Haddon ferry

a short distance east. The ferry operated from 1820 to 1938. Richmond Howard, an old resident, obtained water from the springs as a boy, and remembers the ferry travelers using them.

About 1860 a health resort was built in the Blue Hills 12 kilometers northeast of Burkeville. The principal attraction was **Hickman Springs (6)**, the source of Hickman Creek. Discharging 3.0 lps on January 10, 1976, from Fleming sand, the spring waters passed over waterfalls downstream. The resort failed in a few years. The springs are still there, but difficult to reach.

Burkeville, settled around 1815, had several water-powered sawmills on spring-fed McGraw Creek. The best known was Watt Wilson's mill one kilometer east of town, according to Pauline Hines, the local historian. Serving the mill workers was a small spring (5) which



Site of Wilson mill on McGraw Creek.

produced 0.35 lps in 1976 from Fleming silt. The very rare bloodroot of the Poppy family is found only in this vicinity and in a few other locations in Texas.

Sixteen kilometers southwest of Bon Wier in the Biloxi community are some small springs (8) which issue from Beaumont sand. In the early 1800s they were occupied briefly by the Biloxi and Choctaw bands evicted from their eastern homes. Before long the Anglo-American settlers caught up with them and forced them out of this area also.

Another **Indian Springs (10)**, seven kilometers northeast of Bon Wier, at latitude 30°47' and longitude 93°36', are hard to reach. They include a large number of river terrace springs flowing 2.0 lps in 1976. Atakapan villages remnants, including a large mound, are nearby. According to old-time wolf hunter Goob Newton, bushels of projectile points and stone scrapers have been found here.

Eleven kilometers northeast of Buna are **Wright Springs (9)**, at 30°28' latitude and 93°52' longitude. Discharging from Montgomery sand, they are the source of Spring Creek. According to resident Fred Wright, they formerly flowed with much greater volume than the 0.95 lps observed on January 11, 1976.

## NUECES COUNTY

Because Nueces County is so flat topographically, and also because most of it is underlain by relatively impervious clays, there has not been much opportunity for springs to form, except along the bluffs of the Nueces (Nuts) River and Oso (Bear) Creek. Artifacts found in the county indicate that prehistoric people lived near the springs and on spring-fed creeks as long ago as 14,000 years. But because of natural forces such as hurricanes and changes in river courses, very little evidence of these ancient people, or of the springs which they used, remains.

Most of the shallow lakes on Mustang Island and in other sandy areas contain water that is only slightly saline. The Malaquite Indians and the early Spanish explorers knew that in these areas they could always obtain fresh or slightly saline water by digging a hole a meter or less in depth. Near sand dunes these shallow lakes are fed by seeps emerging from the lower slopes.

Numerous animals and plants are dependent upon the springs and spring- or seep-fed creeks and lakes for their drinking water. Herds of bison and wild mustangs and cattle once roamed the county. Now over 350 species of birds are year-around residents or seasonal visitors.

Groundwater tables have declined because of

heavy pumping, the greatest decline of about 75 meters having occurred in the southwest portion of the county. A large number of flowing wells formerly existed, but the waste of water from these wells plus pumping from other wells has caused nearly all of them to cease flowing.

The remaining spring waters are generally of a sodium chloride type, being slightly saline, hard, and alkaline. The silica and iron content are often high.

The writer visited the county's springs mainly during the period January 13 - 18, 1977. For four months previous to this time, above-average rainfall had occurred. The measurements of spring flow are therefore believed to be higher than normal for this season.

*Agua Dulce* (Sweet Water) Creek is obviously spring-fed, as it rarely ceases flowing. The springs, however, issue chiefly from Lissie sand upstream in Jim Wells County. The ancient Paleo-Indians who lived on the creek just north of Driscoll knew that this stream could be relied upon to supply good water constantly. So also did Blas Maria de la Garza Falcon in the 1760s when he established the Santa Petronila ranch some 15 kilometers downstream from Driscoll, although he was troubled by huge alligators which attacked his stock. But by 1853, when John Bartlett crossed *Agua Dulce* Creek, the cattle of many ranches had reduced the creek to "some filthy pools of water."

Farther up *Agua Dulce* Creek, eight kilometers northeast of *Agua Dulce*, is King or Groeneveld Lake (7). It lies on the H. Groeneveld and Ralph Balko farms. Here, marked by a granite monument, is the site of a battle between Texans and Mexicans in 1836. The spring-fed lake was formerly a popular spot for outings and swimming. Large catches of fish were netted. In 1908 J. C. Mrazek of *Agua Dulce* killed a four-meter-long alligator at the lake. Now it is largely silted up. Gar and turtles survive in the muddy water. White spider lilies and water hyacinths bloom in the pools, shaded by anaqua and other trees.

Just east of King Lake is Banquete Creek, actually an old channel of *Agua Dulce* Creek. Here, according to Balko, were formerly lakes five meters deep. At *Agua Dulce* Lake on this creek in 1832 Mexican and Irish settlers held a four-day feast or "banquet," which gave rise to its name. Now the lakes are largely filled with sediment and cultivated.

One of the most historically interesting spots in the county is Fort *Lipantitlan* (Place of the Lipans), in the northeast corner. In 1690 a mission of sorts was established here, and around 1750 Spanish settlement of the area began. In 1766 Col. Diego Ortiz Parilla probably stopped here. No buildings remain now, but a park



and historical marker are located here. The old mission and later fort were located on a 13-meter-high hill of terrace sand and gravel overlooking the Nueces River. Nearby gravel and sand are being removed from pits. Very likely springs (1) formerly flowed at the base of the bluff below the fort, and furnished water to the early residents. In 1965 the water level in a well in the park stood 17 meters below the surface, or 4 meters below the former springs' elevation. Now the spring site is marked by a grove of hackberry, mesquite, and blackbrush.

Rancho Dismero was undoubtedly founded on Dismero Slough in 1814 because of the abundant springs here. **Dismero Springs (5)** are 15 kilometers northwest of Robstown at latitude 27°54' and longitude 97°45'. They have now been reduced to very small springs and seeps from the base of a sand terrace. Ducks, herons, egrets, and blackbirds abound.

On Oso Creek south of Corpus Christi many artifacts have been found which show that early Americans favored the banks of this creek for campsites. Numerous seeps and very small springs still flow from silts in the banks of the creek. In 1853 John Bartlett found, near the present Highway 763 crossing,

a small pond, or rather mud-hole, the water in which was so bad that the animals would not drink it.

Evidently overgrazing by numerous cattle herds was already a problem here. At this crossing of Oso creek, 13 kilometers southwest of Corpus Christi, 0.32 liter per second was flowing on January 18, 1977, from seep areas (4). Six kilometers downstream, at the Highway 286 crossing, 0.35 lps issued (6). Three kilometers farther, at the Route 43 crossing, 0.65 lps flowed from seep areas (3), and four kilometers still farther downstream, at the Highway 2444 crossing, seepage (2) yielded 0.90 lps. Many other seeps and small springs doubtless exist between these highway crossings. At most of these sites an abundance of rifle and pistol shells and dead birds indicate that numerous "sportsmen" have been firing at any wildlife that moves. Field tests made at the seeps showed that the chloride content now ranges from 400 milligrams per liter upstream to 1,100 downstream. In other words, the water is slightly saline.

## OCHILTREE COUNTY

The springs of Ochiltree County emerge from Ogallala sand, caliche, and gravel. They are, or were, most

common along the larger streams, where a more hilly topography exists.

Ancient people lived at these springs for at least 9,000 years. Numerous varicolored Alibates flint projectile points have been found at their campsites. In late prehistoric time the Plains Village Indians used spring waters to irrigate their crops. The ruins of some of their slab houses may still be seen. The springs were also welcome stops for early explorers such as Coronado in 1541.

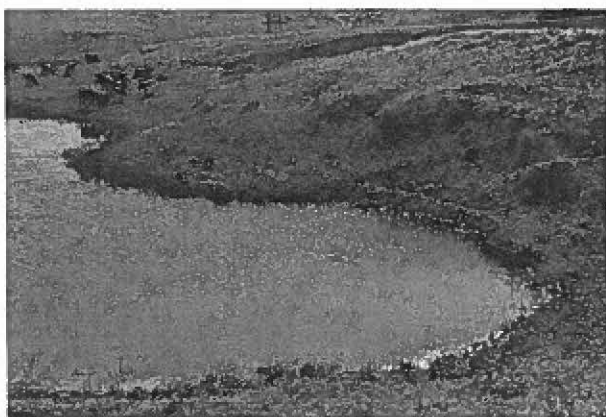
As recently as 100 years ago springs and seeps burst out along all the streams. The larger lakes such as Peckenpaugh, Truax, and Deer Lakes were kept brimful by seepage from the high water table. Tall western-wheat and sand-reed grasses cloaked the prairies. Red cedars, wild roses, plum thickets, grapevines, choke cherries, and currants were abundant. In this luxuriant environment lived deer, elk, antelope, bears, wolves, bison, turkeys and countless other animals.

This has all greatly changed now. Beginning with the ravages of the cattle barons of the 1870s much of the grass was destroyed. Settlers plowed up steep hillsides which should have remained in grass. Huge valley trenches and gullies began to cut headward, releasing appalling volumes of sediment which washed downstream to fill the formerly clear, deep, fish-filled holes and bury springs. The greatest damage was caused later when wells were drilled and the groundwater pumped out, especially for irrigation starting in the 1940s. From 1965 to 1970 the water table declined as much as eight meters. This decline is occurring so fast that many windmill wells can no longer reach water, and must be deepened or abandoned.

As a result of course many of the springs have dried up or greatly weakened, and more disappear each year. Because of the loss of this natural water and of other phases of their environment, many plants and animals which formerly lived here can no longer survive.

The water is generally of a calcium bicarbonate type, fresh, very hard, and alkaline. The fluoride content may be high. Most of the writer's field studies were made during the period June 12 - 17, 1977.

In the northwestern part of the county on the C. F. Frantz ranch are **Wampus Cat Springs (5)**, at latitude 36°25' and longitude 101°04'. The origin of the name is unknown. Burnt rock hearths, metates, and flint projectile points and scrapers, along with bison bones, testify that this was once an Indian campsite. According to Mr. Frantz, the water once would fill a 2-inch (5-centimeter) pipe, and contained many fish. Now there is only seepage which supplies a pool. Frantz could



*Wampus Cat Springs, in box at right.*

formerly predict the weather by observing the spring flow. At times of low atmospheric pressure and coming inclement weather, the discharge would be greater.

In 1900 J. E. Simmons settled on Kiowa Creek ten kilometers southwest of Booker, and used springs here (1) until he could drill a well. His nephew, Bob Beagle, still lives here. Although now dry, the main springs were probably just to the west of the house in the more sandy, hilly terrain on Carol Whippo's ranch. The site is marked by a field of morning glories, with elm, cottonwood, and willow trees.

Gilhula Creek in the eastern part of the county was a favorite resort of Indians. In early settlement days its waters were much used for swimming, fishing, and baptizing. Now, however, its springs have all dried up.

Springs have always been most abundant along Wolf Creek. Starting at the upper end, **Jines Springs (2)** are about halfway between Highways 70 and 83, south of Wolf Creek, on the J. W. Jines ranch. In 1882 the Bar CC ranch used these springs and in 1886 they furnished water for the settlement of Ochiltree three kilometers northwest. A dam was built to impound water for swimming and baptizing. With flower gardens and grapevine arbors this was long a favorite recreational center. As the springs began to fail, shallow wood-lined wells were dug to provide easier access to the water. The dam washed out in 1942. Now there is only some seepage in the channel, in a grove of locust, willow, cottonwood, hackberry, and elm trees.

Five kilometers downstream from Highway 83 on Wolf Creek was the 1874 Jones and Plummer store, on the cattle trail of the same name. Copious springs (3) broke forth here at an elevation of 795 meters. On June 15, 1977, they still poured out 1.3 liters per second. From here to its mouth, Wolf Creek still flows, although it may dry up in the summer. Each dry-up kills the fish,

making the survival of herons, killdeer, and other waterfowl increasingly difficult.

Near Lake Fryer (11) abundant evidence of occupation of the area by prehistoric people has been found. A buried Pueblo city has been unearthed nearby. And early settlers found many travois, used with dogs by the Kiowa Apaches to transport their goods. On June 14, 1977, there was a flow below Lake Fryer of 1.6 lps, 2.6 lps below the junction with Northrup Creek, and 1.3 lps at the road crossing four kilometers farther downstream.

Springs (4) still flow on the Pamell ranch on Northrup Creek amid much water cress. On June 15, 1977, 0.46 lps reached the mouth of the creek.

On lower Cottonwood Creek, which enters Wolf Creek seven kilometers west of Highway 23 at latitude 36°15' and longitude 100°36', there were formerly many springs (7). According to rancher Lawrence Ellzey, a good spring ran in 1917 about four kilometers from the creek's mouth. Other springs also formerly emerged along the channel, but now there is only seepage.

At the Alfalfa Post Office, on the south side of Wolf Creek opposite Cottonwood Creek, there were once small springs (10). Dry now, the site is decorated by firewheels and wine cups in a small grove of trees near an old barn.

**Dietrich Springs (6)** were at Charlie Dietrich's dugout, the first to be built in the county, in 1868. These "large, fresh springs" were in a small canyon just downstream from the mouth of Cottonwood Creek on the north side of Wolf Creek, on the L Z Ranch. Although they are now dry, the site is still marked by a grove of cottonwoods, elms, hackberries, and grapevines.

A little farther downstream Gibson Creek enters Wolf Creek from the south just east of the Lipscomb County line. Springs in Ochiltree County (8) produced a flow of about 0.65 lps at the mouth in 1977.

About four kilometers northwest of the southeast corner of the county W. F. Taylor settled in 1901 near the ghost town of Notla. Errol Flathers, who lives nearby, remembers when springs (9) flowed around 1929 in the breaks below the caprock. Now a windmill is located there, assuring that the springs will not flow again.

## OLDHAM COUNTY

Oldham County has a wealth of springs because of the great differences in land elevation near the Canadian River. But they are much less numerous and copious than they were under virgin conditions. They flow

chiefly from Ogallala sand and caliche and Triassic sandstone, and a few from Permian dolomite.

At practically all of the springs or former springs there is hard evidence of long occupation by prehistoric man, in the form of bedrock mortars, rock paintings, and petroglyphs. Just before the dawn of history in the New World a Puebloan people were living in masonry houses, practicing agriculture, and diverting spring waters to irrigate maize and other crops along the Canadian River. Perhaps they got the idea of irrigation from the beavers who were constantly causing water to flow onto adjacent lands with their dams. In historic times the nomadic Apaches and Comanches often camped at the springs in the county.

When the Spanish explorer Juan de Onate and his company of 70 men came down the Canadian River in 1601, they were pleasantly surprised (Bolton, 1908):

At times it became necessary for us to depart from the main river in order to find a road for the carts; and although we feared the lack of watering places for the cattle, there are so many in this country that throughout the journey at distances of three or four leagues there was always sufficient water for the cattle and for the men; and in many places there were springs of very good water and groves of trees.

Lt. J. W. Abert in 1845, while following essentially the same route, remarked on the "luxuriant profusion of plum trees and grape vines." He described the river bed in Oldham County as 100 yards (91 meters) wide. Other writers have stated that it was much narrower with deep pools, at least in some places. There has been a tremendous change in the river and tributary channels since those days. Plowing up of the grassland produced enormous quantities of sediment from eroded fields and caused deep valley trenches to cut their way upstream. The soil removed was redeposited downstream, filling the once-deep, fish-filled channels and causing them to widen immensely. Now the Canadian River channel averages at least 500 meters in width.

Cultivation also damaged the groundwater reservoir by impairing the capacity of the organic soils to recharge it. In addition, well pumping has taken its toll, so that the water table is declining as much as 0.2 meter per year. As a result most spring discharges have decreased or ceased.

Originally the bluestem meadows were alive with wild game, including bison, wolves, cougars, antelope, deer, elk, bear, wildcats, wild mustangs, prairie dogs, ducks, and plovers, which depended upon the springs to supply water and food. With the disappearance of

many springs and the destruction of their natural habitat, many of these wildlife species can no longer survive in the county. In this drier environment cholla and yucca are replacing the more desirable grasses.

The spring waters are generally of a calcium bicarbonate type, fresh, very hard, and alkaline. The silica content may be high. The writer's field studies were made primarily during the period May 1-7, 1977.

The first permanent settlers in the county were Mexican-American sheep raisers around 1870. One of these settlements was Salinas Plaza, just north of the Canadian River and seven kilometers east of the state line. There are very small saline springs (7) here and a salt lake, much used for salt by early settlers and the Indians before them. **Sanchez Spring (10)** is a very small spring to the west, almost on the state line.

About ten kilometers northeast at the mouth of a canyon was another Mexican-American settlement called Chavez Plaza. These people were driven out by the cattle barons in the 1880s. The remains of eight homes can still be seen here. About two kilometers up the canyon are the largest surviving springs in the county, **Chavez Springs (3)**, often spelled *Charvis* now by the Anglo residents. They are on the Spring Creek ranch, operated by Alvin Payne, at latitude 35°29' and longitude 102°52'. Here is a collapse zone, and Permian dolomite beds dip in all directions toward the springs. Many small springs issue from fissures in the collapse zone at about 1,075 meters elevation. They made up a flow of 4.5 lps on May 5, 1977, which plunged over a waterfall among maidenhair ferns into a pool inhabited by large frogs and fish. The flow is reported not to weaken in summer. Surrounding the springs is a grove of elms, cottonwoods, and arroyo willows with many birds such as killdeer and red-winged blackbirds. Dark gray soils indicate that a bog once extended about one kilometer upstream. It has been incised and drained by a headward-cutting valley trench. The spring water was used for crop irrigation by the Chavez Plaza residents.

**Ojo Caballo or Horse Spring (4)**, twelve kilometers southeast of Nara Visa, New Mexico, on Jack Shelton's ranch, was the source of Horse Creek when it flowed more copiously. It emerges rather high on a hillside from Triassic sandstone, producing 0.063 lps of fresh water (288 milligrams of dissolved solids per liter) in 1938 and 1977. It formerly emerged from a rock ledge, but has now moved down the hill. Amid a bed of water cress it flows into a small stock tank, largely silted up, in a cottonwood grove. Antelope and lark buntings may be seen here.



Two kilometers farther south are **Sidle Springs (5)**, which emerge from large holes in sand and gravel. Flowing through much water cress, they supply fresh water to a large stock tank containing many fish. In 1938 they produced 4.0 lps, but in 1977 the flow was only 0.50 lps. Seven kilometers east of Sidle Springs are the very small **Oil Well Springs (8)**.

Two kilometers farther southeast are **Chisum Springs (2)**. Here many seeps from Triassic sandstone accumulated to a flow of 1.9 lps on May 5, 1977. They are surrounded by cliffs and boulders, yellow with senna flowers in spring. Downstream long-billed curlews feed at fish-filled pools, shaded by cottonwoods. To the east is a boulder with four shallow mortar holes in it. Farther downstream at the mouth of the canyon John Chisum built his dugout in 1876.

**Ojos Bravos or Bold Springs (1)** are located nine kilometers east of Nara Visa, N.M., on Jack Shelton's Bravo ranch, managed by Joe Hughs. Several springs emerge from sand in boxes to feed a small pond. The flow was 1.1 lps on June 22, 1971, and 1.4 lps on May 4, 1977. The pond overflows in winter. In summer, when the cottonwood trees and evaporation draw more water, it does not overflow. A Comanche settlement existed here. In 1888 a division headquarters of the XIT ranch was established here. The old headquarters building is still in use. **Bull Springs (35)**, a few kilometers east, are now only seeps.

Eight kilometers northeast, on Minneosa Creek, are **Minneosa Springs (18)**. In 1977 they produced a flow of 0.19 lps from sandstone bordering the creek and ran 300 meters downstream. Many birds, including hawks and doves, are found here. A number of bedrock mortars are present on the sandstone bluff east of the creek. Some are circular and some are oval-shaped, possibly reflecting different tribes or uses. Some are relatively recent and sharp in outline and others are severely weathered, indicating long prehistoric use of the site by man.

Farther east, on the Proctor ranch, managed by Junior Hays, were the **Pedarosa or Pedriza (Stony) Springs (6)**. Dry now, they were located at latitude 35°35' and longitude 102°40'. A windmill at the site no doubt hastened their demise. Another **Oil Well Spring**, also very small, is located nine kilometers northeast.

In the vicinity of Cal Farley's Boys' Ranch at Tascosa a number of moderately large springs formerly issued from Triassic sandstone on top of shale. They are greatly reduced in flow now, chiefly as a result of irrigation and other pumping. At the west end of this group, 10 kilometers west-northwest of the Boys' Ranch head-

quarters, were some springs (11) on the Fulton ranch. Flowing 1.7 lps in 1938, they are only seeps now. Three kilometers southeast was another group which flowed 1.6 lps from the river bank, but these are now gone.

Three kilometers northwest of the Boys' Ranch headquarters are **Briggs Springs (12)**. Here Theodore Briggs settled in 1876. The fresh water supplies an irrigation reservoir. The flow was 6.3 lps in 1938. In May, 1977 it amounted to 0.32 lps, but according to Jack Hardin of the Boys' Ranch it dries up in summer.

Three kilometers west of the headquarters are **Rica (Abundant) Springs (36)**, on Rica Creek. Their fresh-water flow was 9.5 lps in 1938 and 0.32 in May, 1977, which is reported to fail in summer. Across the Canadian River, Juan Trujillo established a sheep ranch in 1877.

**Atascosa (Boggy) Springs (13)** are close to the Boys' Ranch headquarters buildings, on Tascosa Creek. Some old Pueblo ruins are nearby. In 1845 Abert described them thus:

About noon we found a stream of delightful cool water, which ran swiftly along the bottom of a deep-cut ravine, completely shaded from the sultry sun by the luxuriant growth of grass and reeds which overtopped the backs of our mules. We frequently stopped and drank of the pure stream as we followed it to its source in order to head it, as we could not cross without great difficulty.

The boggy condition was probably caused by beavers, which were numerous here. In 1876 blacksmith Henry Kimball settled at the "big springs gushing from the hillside." He planted the cottonwoods which still stand at the Boys' Ranch. In 1887 residents of Tascosa (now the Boys' Ranch) complained that the creek downstream from Atascosa Springs was frequently impossible to cross and that a bridge was needed. The creek was a favorite spot for fishing and wild plum and grape parties. In 1888 a water supply from the springs to Tascosa was built. In 1938 the flow was still 13 lps, but by 1977 it had decreased to 1.9 lps. The springs feed a recreational lake containing large bass and catfish.

One kilometer east of these springs are **Romero or Morris Springs (14)**. Here in 1876 sheep herder Casimiro Romero settled at the site of an old Indian village. The springs still produced 3.2 lps in 1938, but in May, 1977 were down to 0.65 lps, and are reported by Jack Hardin to dry up in summer. Many nearby pumping wells have contributed to the decline. The springs supply two lakes which are used to irrigate an orchard.

Three kilometers east of the Boys' Ranch headquarters on Pescado Creek on the Bivins ranch are **LIT**

**Springs (15).** Located at the 1877 Littlefield ranch headquarters, they now supply ranch manager Jim Hill's home and a recreational lake. Shaded by cottonwoods, much water cress and grape vines surround the springs. Their flow has decreased from 4.7 lps in 1938 to 0.65 in 1977. Near here, Abert (1845) stated,

Shortly after [passing Atascosa Springs] we saw two large patches of ground covered with a seeming coralline formation, whereupon Lieutenant Peck and myself dismounted to procure specimens. We found the madrepore structure wanting; and concluded, from its peculiar friability and composition, that it must be a silicious deposit of some extinct thermal spring.

This formation, probably travertine deposited by a former spring, can no longer be seen, and probably has been buried under sediment eroded from the adjacent hills.

Two kilometers farther east are **Bivins Springs (16)**. They flowed 6.3 lps of fresh water in 1938. Now they are only seeps which feed a lake, and are reported to dry up in summer.

In the extreme eastern part of the county, 6 to 14 kilometers south of the Canadian River is another group. Among these are **Lost Tubs (33)**, **Granite Tubs (30)**, **Division Pens (31)**, and **Prairie Dog Springs (32)**.

Twelve kilometers northeast of Vega was a very small spring (37) in a canyon, on a tributary of Sierita de la Cruz Creek. This was probably the place described by Lt. A. W. Whipple in 1853 while surveying for a railroad (Archambeau, 1971), as follows:

Our route passed two large pools of water before arriving at Rincon de la Cruz, a canon of the Llano Estacado. Here we encamped beside a spring and a natural vineyard of wild grapes. The fruit is as large as a hazel-nut, with thin skin and deep purple juice. It could be greatly improved by cultivation. Mr. Marcou thinks it would make an excellent wine similar to Port.

This spring, in 1938, produced 0.03 lps, on the Landergin ranch.

**Alamocitas or Little Cottonwood Springs (22)** are 21 kilometers north-northeast of Adrian on the Scharbaaur ranch, managed by Ken May. This was a division headquarters of the XIT ranch in the 1880s. The thick-walled house still stands. In 1907 the springs flowed 14 lps. In 1977 they were reduced to a combined discharge of 1.7 lps in winter. The main springs are at the old headquarters but others occur as much as seven kilometers upstream on Alamocitas Creek. The

creek runs to about four kilometers downstream from the headquarters in winter and somewhat less in summer. Shaded by cottonwood and locust trees, wild plums and grapes abound. Deer, antelope, and turkeys water here, and huge bullfrog tadpoles, 20 centimeters long, may be seen in the pools.

About four kilometers southeast are **Skunk Springs (23)**, on Skunk Arroyo. They are now covered by an 0.4-hectare earth tank. In 1977 they supplied sufficient water to balance the evaporation, 0.21 lps, but there is usually no overflow. The water is clear, deep, and contains many aquatic plants.

**Big Springs (24)** on Skunk Arroyo, also on the Scharbaaur ranch, are five kilometers northeast of Alamocitas headquarters. In 1907 Gould described them as flowing more than 28 lps. On May 5, 1977, they were covered by a 1.6-hectare lake, producing sufficient water to counter the evaporation (0.84 lps) but no overflow. Shaded by cottonwoods and elms, catfish, bass, and bullfrogs abound in the cattail-filled water.

From 5 to 12 kilometers northwest of Alamocitas are a number of other small springs. These include **Humdinger (25)**, **Rock (26)**, **Joaquin (27)**, **Lost (29)**, **Cheyenne (37)**, and **George Springs (28)**.

Nine kilometers west of Adrian is Rocky Dell, on the Tom White ranch. John Gruhlkey, who leases the land, guided the writer to this picturesque spot, where spring waters passed a large sandstone rock shelter containing numerous historic and prehistoric paintings and carvings. A large pictograph of a plumed serpent was probably made by the Puebloan agricultural people who lived here many centuries ago. As Kirkland and Newcomb (1967) state,

The plumed serpent, guardian of springs and streams, was almost certainly placed there out of concern for the ever-present problem in that land — water.

Rocky Dell.



In 1840 Josiah Gregg's trading caravan stopped here. He called the place **Agua Pintada** (Painted Water) or **Agua de Piedras** (Water of the Rocks). The springs were also reported by Lt. A. W. Whipple in 1853. He described a flowing stream fed by **Rocky Dell Springs (21)** which passed through the gorge. By 1938 the flow had been reduced to seeps of fresh water. Seeps and standing pools of water still exist today. On the sandstone bluffs are hundreds of bedrock mortars, possibly used to grind meat and berries into pemmican. Included is one of great age which has a 2-millimeter coating of what appears to be manganese oxide on the inside. On the cliffs are the mud nests of cliff swallows. (See Plate 4, b). Both mule and white-tail deer frequent the site. Six kilometers north-east are **Lost Mule Seeps**, which were formerly a stagecoach stop.

Seven kilometers east-northeast, on the Masten ranch, managed by Ray Brown, are **Dripping Springs (20)**, once a bog camp on the XIT ranch. Though small, they are set in beautiful surroundings. The springs issue from Permian dolomite at the top of a cliff of red shale. Large blocks of dolomite lie at the base among cottonwoods and grapevines. Deer may be seen watering here, and the cliffs are adorned with cliff-swallow nests. The flow was 0.65 lps on May 6, 1977.

**Blue Goose Springs (19)** are on Trujillo Creek on the Masten ranch. Located at latitude 35°25' and longitude 102°54', they produce 0.24 lps from sandstone. The water is fresh, containing 455 milligrams of dissolved solids per liter, as shown in the table of Selected Chemical Analyses. In a cottonwood grove here many birds, including hawks and yellow and orange warblers and orioles, make their homes. Near here also are some historic petroglyphs carved in sandstone.

In the southwestern part of the county, 14 kilometers north-northeast of Glenrio, are **Brown's Camp Springs (17)**, on the Windham ranch. Feliciano Guerrero, who lives here, guided the writer to them. In May, 1977, three larger ones flowed 0.60 lps each from Triassic sandstone on top of shale. Maidenhair ferns and grapevines drape the springs, shaded by wild plum and cottonwood trees. Several smaller springs, which dry up in summer, brought the total flow to 2.5 lps. The water runs about four kilometers down Trujillo Creek before disappearing. Nearby are some petroglyphs or rock carvings of horses and cows made by Indians during historic time. The smaller **Signal Spring (34)**, is eight miles east.

## ORANGE COUNTY

Being located in relatively flat country, Orange County cannot be expected to have any large springs. However, there are many small springs and seeps. These attracted the Atakapan Indians, who liked to set up their villages of thatched huts near springs and spring-fed creeks. For many thousands of years they gathered clams and oysters, forming shell mounds or middens. These mounds have now largely been destroyed and the shell used for road construction.

In 1519 Alonso de Pineda, mapping the coastline, named the Sabine River *San Francisco de Sabinas* for the many cypress trees which grow along its course. He may have sailed up the river in search of fresh water. By the eighteenth century both Spanish and French explorers and traders were well acquainted with the Atakapans. In 1718, a party of French explorers went ashore at an Atakapan village on Sabine Lake, got all the male Indians drunk, and kidnapped and sailed off with the women. Of course they were familiar with the springs upon which the Indians depended.

Well pumping has caused a decline of as much as 20 meters in groundwater levels in recent years. This has of course reduced and stopped the flow of many springs. It has also caused land subsidence with its concomitant damage to structures and increased flooding.

Most of the writer's field studies were made on January 12-17, 1976.

The spring water is usually of a sodium bicarbonate type, and is fresh, soft, and alkaline. The content of silica or chloride may be high.

Fourteen kilometers northwest of Vidor, in the Lakeview community, are **Lakeview Springs (5)**. Flowing 0.95 lps in 1976 from Deweyville silt and sand, they are reported to fail sometimes in dry, hot weather. As they discharge into the Neches River, they were probably frequently used by the Atakapans on their canoe trips up and down the river.

**Sandy Springs (4)** form Sandy Creek 12 kilometers west-northwest of Orange near Interstate 10. Here a large number of springs and seeps discharged 0.60 lps from a marshy area of Beaumont sand in 1976. This was a favorite camping area of the Atakapans. In the late 1700s early settlers began to use the springs also.

**Gum Springs (1)** rise along Gum Gully about 10 kilometers northwest of Orange. They include many very small springs and seeps flowing 1.0 liter per second in 1976 from Beaumont silt. Around 1830 and later, cattle drives passed this spot on their way to Morgan





Cooper Springs.

Bluff and points east. In 1836 a lumber mill made use of the water here. All of the virgin timber has been cut from this area, but many unusual animals still live here. These include fish such as the cypress darter, the virtually transparent scaly sand darter, and two tiny catfish called the tadpole madtom and the freckled madtom. Nowhere else in Texas can so many amphibians be seen and heard. After rains, the green frogs, pig frogs, bronze frogs, and bullfrogs produce a ragged cacophony.

**Cooper Springs (3)** discharged 1.1 lps in 1976 from Beaumont sand in the vicinity of Jayway and 10th Streets in Orange. Some of them are high in iron content. Captain Joaquin Orobio y Bazterra probably stopped here in 1748 on his journey east from Presidio La Bahia. The springs were probably used by Green's Bluff (Orange) settlers as early as 1828, when John Harmon and his family arrived from upriver by raft. Downstream at the Cooper Bayou pumping station the spring water is lifted about three meters and discharged into Sabine Lake.

## PANOLA COUNTY

Panola County is well endowed with numerous springs. Most of them have not declined appreciably since the days when the Hasinai and Yatasi tribes built their villages of beehive-shaped thatched lodges near the springs. Groundwater levels have declined notably in areas of heavy pumpage, but in general the demands on the groundwater reservoirs have not been great.

Nearly all the springs in the county issue from sands in the Wilcox formation. The waters are generally fresh, soft, and acid, and of a sodium bicarbonate type. The content of iron, magnesium, or sulfate may be very high, especially in the so-called "mineral" springs.

Most of the writer's field studies were made on

January 25-30, 1976.

The early community of Carthage grew up in 1819 around **Carthage Springs (5)**, located mainly in the vicinity of the intersection of Live Oak and Cottage Streets. Later a leather-tanning yard used the springs, which flowed 0.68 lps on January 29, 1976.

**Mineral Springs (4)** are located four kilometers southeast of Tatum on the south side of Highway 149. The Anadarkos had a village here in early historic time. In 1687 Henri Joutel and part of La Salle's party may have stopped here en route from Fort St. Louis to Quebec, Canada. In 1833 Daniel Martin and his family settled at these springs and built a small fort. The spring waters were widely used by other settlers. Later a logging camp was located here. The flow was 0.05 lps in 1976.

**Bethany Springs (2)** are about two kilometers southwest of Bethany, in a wood on an oil-field road. Here the Yatasi had a village in prehistoric times. In 1840 Bethany Springs were a stopping place for settlers coming into Texas. Some liked the area and stayed. Nearby was a water-powered grain mill. The springs discharged 0.35 lps in 1976.

Seven kilometers southeast of De Berry and 200 meters east of Midyett church are **Midyett Springs (3)**. Early residents travelled long distances to obtain this sweet water which is high in iron content. For many years the springs supplied a school. In 1976 they flowed 0.21 lps, enclosed in a charming gazebo or shelter at about 90 meters above sea level. (See Plate 16, b).

About one kilometer north of the Deadwood store are **Le Grone Springs (1)**. These are the "beautiful springs" at which Adam Le Grone and his family built their cabin in 1837, according to Leila Belle Le Grone, the local historical authority. Long before this they were occupied by a village of Hasinai. They flowed approximately 0.55 liter per second in 1976. Many other



Bethany Springs

springs trickle in the vicinity.

**Daniel Springs (7)** are at the Daniel Springs church encampment three kilometers east of Gary. They include two groups of springs, each flowing at about 0.65 liter per second in 1976. A Cherokee village was located here for a time. These are believed to be the same as Brown Springs, mentioned by Deussen in 1914. He described them as being located in the community of Cozart, which apparently has faded into oblivion. The springs are, however, adjacent to Hiram Cozart's place.

Six kilometers south of Gary are **Cave Springs (8)**, difficult to find in a wood. They rise along a large, displacement fault in the Queen City sand, which forced the flow of 0.35 lps in 1976 to the surface. They were once a Wells Fargo stop on the old Carthage-Nacogdoches road. Later, they were a very popular spot for outings.

**Davis Springs (6)**, three kilometers southwest of Clayton, were a social center when this area was settled in 1836. Their water is high in iron and sulfur content. When Deussen (1914) reported on these springs, they were flowing 1.3 lps and from a higher elevation. In 1976 they furnished 0.95 lps of water for the C. Robinett home.

## PARKER COUNTY

Parker County was in past millenia abundantly endowed with springs. They often were used as homesites by the Wichitas and their predecessors. In 1778, when Athanase de Mezieres traversed the county, he was greatly impressed by the many springs and their associated wildlife (Bolton, 1914):

The attractiveness of the lands which I have traversed for the distance of eighty leagues is inexpressible, with respect to the numerous springs and creeks which encourage the irrigation of the adjacent plains, the woods that beautify their banks, the rocks which, making their bottoms firm, facilitate the construction of the dams that may be undertaken, and, finally, the abundance of buffalo that feed in their neighborhood. Their number is so great that, already having a superabundance of this savory food, it was not a necessity but a vice wantonly to destroy so estimable a gift of divine providence, which, manifesting itself also by numerous herds of deer, antelopes, turkeys, partridges, geese, cranes, rabbits, and hares, gave no place for noticing fatigue, but furnished recreation and diversion. Nor was any thought given to the mere satisfaction of hunger, but only to seeking for luxuries.

It is worthy of note that from the Brazos River, on which the Tuacanas are established, until one reaches the river which bathes the village of the Taouayazes, one sees on the right a forest that the natives appropriately call the Grand Forest. It is very dense, but not very wide. It seems to be there as a guide even to the most inexperienced, and to give refuge in this dangerous region to those who, few in number and lacking in courage, wish to go from one village to another.

The Grand Forest which he described is now known as the West Cross Timbers. This is the area of Paluxy sand in the eastern part of the county which carried much water, produced many springs, and hence supported a good growth of timber. The timber was later cut and the land put in cultivation, a great mistake, as the sandy soil was very easily eroded.

As an example, in 1877 there was a pool in the Clear Fork of the Trinity River at Poolville 200 meters long, fed by cold springs, from which the town got its name (Holland, 1937). This was a very popular place for early settlers to gather and wash clothes. Now the pool is completely filled with sand. However, on July 6, 1976, 3.3 liters per second were still emerging (after heavy rains) to flow over the rock ledge just below the Highway 920 bridge.

Groundwater levels have declined since the county was settled. As a result, many springs have ceased flowing. Others have been buried beneath sand deposits and no longer flow at the surface although they still move underground through the sand. Most of the writer's field studies were made during the period July 3-8, 1976.

The water is generally of a calcium bicarbonate type, and is fresh, very hard, and alkaline.

Weatherford was formerly endowed with many fine springs. These were very well described by Smythe (1877) as follows:

in very dry seasons . . . , in some instances, it occurs that the sand accumulations stop the fountains. In such cases the removal of the impediment, or the deepening of the well a few inches, insures an adequate supply. One mile southwest of the town, on the old Government road leading to Fort Belknap, is the "Old Soldier's spring" — never-failing — where travelers usually camped in former years. It is pure water flowing from a sandstone rock. South of the square, 600 yards, is Gant's spring; north of west, 500 yards, is the chalybeate spring, and east, 600 yards, is one near the lower mill. These springs have never failed to pour forth their bright, sparkling waters. There are other springs which the creek above referred to, has interfered with, but if cleaned out and properly protected would doubtless yield their quota of the aqueous element. It is clear, therefore, that with the springs in the east, north, west, southwest and south, which have never been known to cease their flow, there can be but little probability that a proper effort to obtain water in any portion of Weatherford, will ever be crowned with ill success. The water is generally limestone. . . .

It is interesting that even then, over 100 years ago, accelerated soil erosion caused by man's activities was filling the stream channels with sand.

**Old Soldier's Springs (1)**, which flow from three openings in large boulders of Paluxy sandstone, are in Soldier Park, recently developed under the direction of

Mrs. Grace Cartwright. The very small flow supplies a pool below the springs, but is not sufficient to cause any overflow. The *chalybeate*, or iron-bearing, spring (5) flowed 0.65 lps in 1976 in a grove of large trees. George Kelly, who lives here, says it has never failed since 1904. **Gant's Spring** has dried up, no doubt due to well pumping in the vicinity. The spring *near the lower mill* should be near the Bradfish Grain Company building, but Henry Bradfish has not seen it in the 60 years he has done business there.

Smythe also described a large, never-failing spring of limestone water (11), nine kilometers northwest of Weatherford. It formed the head of Town Branch, which flowed through the town. This spring flowed 3.0 lps from Paluxy sand on July 6, 1976.

**Ballou Springs (12)**, named for early settler E. C. Ballou, were at the Ballou Springs church 12 kilometers south of Whitt. Sometimes spelled *Ballew* or *Blue Springs*, they flowed from Mineral Wells sandstone in a grove of post oak. The old McCleskey cabin formerly located here has been moved to Weatherford. The mineral springs were valued for their healthful properties. People came great distances to partake of them. Camp meetings were held here in the 1870s. The springs still trickled in 1931, but failed soon after.

**Trapp Springs (20)** were one kilometer east of Garner on Robert Pond's ranch. An archeological site near here has yielded projectile points, metates, and manos, some 1,500 years old. In 1877-78 the adjacent Trapp Springs school used the spring water, according to Chloe Fine Smith, a long-time resident nearby. Dry for many years, the site is now marked by a few willows and plum thickets.

In 1854 Arthur Lawrie travelled through Parker County. He camped on Pinnell Prairie, which divides the Trinity and Brazos River drainage basins, 11 kilometers northwest of Weatherford. Here he found much game, wood, water, and grass. In his words, "Hard by were excellent springs." He referred to **Stimson Springs (10)**, which drain into Willow Creek and the Trinity, and **Cold Springs (19)**, which pour into Grindstone Creek and the Brazos River. Grindstone Creek acquired its name from the grindstones made from Paluxy sandstone here.

Cold Springs are five kilometers south-southwest of Peaster on Arnold Keel's ranch. Numerous projectile points and other artifacts found here indicate that this was a favorite campground long ago. In historic times it was a stage stop on the Fort Worth-Fort Belknap road, according to nearby rancher Everett Walden. Until 1940 many outings and picnics were held here. Later the surrounding gullies were dozed in, partly covering

the springs. On June 18, 1978, the discharge from Paluxy sand was 0.15 lps. The flow is stronger in winter, according to Keel. The water supplies two ponds and is used for swimming and irrigation of garden crops. Ducks, fish, garter snakes, water striders, whirligig beetles, and horned toads live in the springs' environment. Walnuts, willows, grapevines, plum thickets, cattails, and rushes, are numerous.

Stimson or **Stimpson Springs (10)** are three kilometers south of Peaster on Highway 920. They produced 0.50 lps from Paluxy sand in 1976. **Sweet Springs**, five kilometers east, are very similar.

Eight kilometers southwest of Springtown are **Indian** or **Carter Springs (6)**. In 1858 Charles Goodnight called them **Rock Springs** when he built the still-standing large stone house for his mother and stepfather three kilometers southwest. By 1866 the village of Carterville had grown up around the springs. A flouring mill used the then-abundant waters for power. Carter church still stands 300 meters west of the springs, but otherwise the town has disappeared. The springs trickled 0.13 lps in 1976 from Paluxy sand on top of a bed of soft sandstone which has been carved by the water into deep ravines and strange shapes. Many names and initials have been cut into the soft rock amid maidenhair ferns, grapevines, and moss. (See Plate 6, e). The springs now supply a one-hectare lake on Gordon Wiley's ranch.

Veal Station was settled in 1852, seven kilometers south of present Springtown. About one kilometer to the west, partly on R. G. Moore's property, were **Veal Springs (7)**, which fed Walnut Creek. The scene was well depicted by Holland (1937):

It [the meeting house] was constructed upon the hills of the "Great Divide" between the branches of the Trinity River and looked down on a valley in a bend of Walnut (now Woody) Creek whose waters were as clear as crystal and have never run dry. Its banks were clustered with walnut trees which produce walnuts with a rare flavor. The creek at Veal Station in pioneer days was known far and wide as the place to camp where one could take a bath and wash his clothes. The first pioneers settled here because there was lasting wood and water.

This had also been a campsite for the ill-fated Santa Fe expedition in 1841. Neither the wood nor the water lasted. Walnut Creek is now dry here except for some pools of standing water.

When Springtown was settled in 1859, according to Smythe (1877), it "abounded in springs of pure cold water moderately free from limestone" (8). Ernest Hutcheson, who spent most of his life in Springtown,



and Bailey Gilleland, a present resident, remember three of the more important springs: **Smith Springs** in town, **Malone Springs** one-half kilometer west, and **Kinnard Springs** one kilometer east. All produced fresh water from Paluxy sand. Smith Springs provided a popular swimming hole. Holland's 1937 description of Smith Springs and the erosion problem is accurate:

The town received its present name because of the beautiful springs that came to the surface on the creek bank just south of the public square. They were very large springs and furnished an abundance of pure water for many years to the settlers and livestock. Because of erosions of lands up creek year by year, the springs have disappeared under a cover of sand and are just a memory. At one time, Springtown had many flowing wells of artesian water, but they too, for the most part, have ceased their flow.

The other Springtown springs also disappeared in the 1930s, both because of declining water tables and because of channel filling with sand, which is up to five meters thick. In 1978 the Walnut Creek channel through town was cleaned out, but the springs are still dry.

In Reno, 10 kilometers east of Springtown, are **Reno Springs (9)**, just west of the Walnut Creek church. In the words of Holland,

In early days the creek was two or three times the present width. Just below the road as it now runs, the waters of the creek divided, later uniting, thus forming an island of a half acre or more studded with large burr oak and walnut trees, forming a very beautiful natural setting which was used in the earlier days as a site for picnics and protracted meetings. Just west of this island was a beautiful spring that later furnished water for the gin. The island and spring have entirely disappeared.

The island has certainly disappeared, but the springs still produced a reduced yield of 0.60 lps in 1976, *Spring Falls*.



issuing from Paluxy sand on top of a ledge of limestone. A series of very small springs and seeps flows along a stretch of about 100 meters on the west bank of Walnut Creek. The walnut trees are still there, but no bur oaks.

**Bluff Springs (2)** were eight kilometers south of Azle, 100 meters southwest of the Bluff Springs church on Highway 1886. Located in a wood, they formerly flowed from Paluxy sand on top of a limestone bed, but are dry now.

**Mary Springs (3)** were 18 kilometers east-northeast of Weatherford at latitude 32°47' and longitude 97°36'. They formed a campsite for the Santa Fe expedition in 1841. They flowed from the Goodland limestone, which is the same age as the Edwards and associated limestones, from which the largest springs in the state flow farther south. Now there is only some water in pools here. The owner, Mike Kavanaugh, says that seeps flow in wet weather from the limestone.

Thirteen kilometers east of Weatherford on Interstate 20 are **Willow Springs (18)**. They are 100 meters southeast of the Willow Springs cemetery in a grove of large trees on the property of the Pearson Equipment Company. They were much used by the early settlers in this community. At Willow Springs cemetery is buried Martha Sherman, killed by Indians in 1860. On July 3, 1976, Willow Springs produced 0.50 lps from Paluxy sand. The site was greatly disturbed by the construction of Interstate 20.

Ten kilometers southeast of Weatherford are **Cason Springs and Falls (16)**. Here a man named Cason killed and robbed a travelling companion, according to Mrs. Rose Odom who lives here. The springs issue from the Goodland limestone and fall over a very hard layer of Walnut limestone, beneath which is a protected shelter. The flow on July 7, 1976, was 1.0 lps. A grove of pin oak, hackberry, and redbud trees grows in the boulders around the falls. The area is very interesting geologically. To the southeast there are a series of similar overhanging cliffs or rock shelters on small tributaries, which must have provided homesites for many Paleo Indians. Now most of them are dry, but at **Spring Falls**, 8 kilometers southeast, there was a flow of 0.63 lps in 1976.

Mention should also be made of the springs along Bear Creek in the southeastern part of the county. In the 1870s three flourishing mills used the water from these springs for power. According to Taylor (1904), increased grazing caused the springs to dry up, probably because of compaction of the surface soil and reduction of natural recharge. Bear Creek was still flowing 2.9 lps at the Highway 377 bridge on July 8, 1976, a considerable reduction from the flow which formerly

powered the mills.

The Spring Creek cemetery was the site of an early settlement. Twelve kilometers south of Weatherford, many springs (17) give rise to Spring Creek in this vicinity. The oldest legible date in the cemetery is 1856, but some unreadable stones are probably older. The springs were of course the reason for settling here. They discharged 0.75 lps from Paluxy sand in 1976.

Early in the nineteenth century settlers began to come up the Brazos River by boat. On the river in southwestern Parker County, at latitude 32°38' and longitude 98°00', is the Jones cemetery, which marks the location of a settlement of the 1840s. Here, in an area where much of the land has been scarred by strip-mining of limestone, are **Jones Springs (15)**, 100 meters north of the cemetery. Many settlers came long distances to wash clothes and obtain water from these springs, according to Mrs. David Jones, who lives there now. The springs flow from a massive bed of Lazy Bend limestone, but the water probably originates from the overlying Twin Mountains sand. There is much water cress, mint, and copperhead snakes in the marshy area around the springs, all in a grove of cottonwoods. The flow in 1950 and 1976 was 0.50 lps.

Another old settlement on the Brazos River was on Harlan Jones' farm, five kilometers farther northwest. Here there was an old ferry and later a bridge, one kilometer south of the present Interstate 20 bridge. The reason for locating the ferry here was in part some good springs (14), which trickled 1.9 lps on July 6, 1976, from Grindstone Creek limestone. The springs supply water to two homes. The water is reported to have been contaminated by pipeline breaks in a nearby petroleum pipeline, but it now tastes fresh and pure.

Four kilometers farther northwest, also near the Brazos River, was the **Soda Springs** settlement of the 1850s. The springs (13) are nine kilometers southwest of Millsap and 200 meters north of the Soda Springs cemetery, where a number of Indian victims are buried, on Madison Youngblood's farm. An old church formerly stood at the springs, which were walled up with brick. In 1858 several men were killed in a shootout here. The springs flowed 0.65 lps on July 3, 1976 from a massive bed of Grindstone Creek sandstone in a grove of post oak and bois d'arc trees. The name Soda indicates that the water is high in sodium carbonate.

## PARMER COUNTY

No springs any longer flow in Parmer County, but up until around 1900 many issued from Ogallala sand and caliche along the major draws. About 30 kilometers

west of the state line in New Mexico and opposite to the Parmer-Bailey county line is the nationally recognized Blackwater Draw archeological site. Here the remains of extinct forms of mammoth, bison, camel, horse, antelope, wolf, coyote, peccary, deer, and badger have been found at the site of ancient springs. Associated with them are butchering and hunting tools which have been dated by radiocarbon methods at up to 11,500 years old. In Agogino's words (1968),

Of greatest importance was the presence of natural springs flowing from numerous locations along the north and west side of Pleistocene Lake, Blackwater. Both men and animals were probably attracted to these springs, the principal source of water for the ancient lake. About these springs was a concentration of butchered animal bones, suggesting Paleo-Indian camps about these now dry springs. A heavy concentration of artifacts, largely unbroken, seems to come from the spring region and may have been "offerings" to the spring waters. These springs, indicated now by the presence of pure white sand, have produced as many as 250 artifacts from a single restricted location. These are naturally polished by post water and sand-spring action. Artifact concentration within the springs shows that they flowed from Clovis to Archaic time, but each individual spring has an internal dominant artifact collection, showing that the springs were not all functioning at the same time, but instead were used by different cultures at different time periods.

Of course these ancient springs were not confined to New Mexico. Many probably poured out in the present Parmer County area. Also found at Blackwater Draw were the oldest artificial wells known in the New World, some 6,000 years old. These were probably dug by the Paleo-Indian people during a drought when the springs failed to flow.

Irrigation has been the prime offender in mining the groundwater and causing the water table to fall as much as one meter per year, although there were earlier factors such as flowing wells and overgrazing. When Farwell was founded in 1905 the grass was 1.2 meters high and had to be burned to survey the site. Blue quail, antelope, wolves, and wild horses were still numerous. Now they are all gone, due to the destruction of the springs and their natural habitat.

The spring waters were of a sodium bicarbonate type, very hard, fresh, and alkaline. The content of silica and fluoride was often high.

The writer's field studies were made chiefly during the period April 8-13, 1977.

On Frio (Cold) Draw about one kilometer east of the state line on the north side, Ben Splawn of Muleshoe remembers a spring (5) which flowed from a cave in about 1927. As Carl Schlenker, who has lived in nearby Rhea since 1918, does not remember it, it probably

flowed only intermittently during its last years. The spring apparently flowed from beneath a ledge of caprock which formed a shelter at an elevation of 1295 meters. Probably this was a favorite campsite of early Americans. The site is now largely covered by an irrigation reservoir.

An old Comanche trail from Roaring Springs to Santa Fe followed Running Water Draw through Parmer County, because there were springs and running water here. The Spaniards called this area *Las Llanos de Agua Corriente*, or the Running Water Plains. According to Indian legend, the creeks in this area were formerly deep flowing streams. With the coming of the white settlers the channels filled with sand and never flowed again.

At Mustang Lake, four kilometers north-northwest of Bovina, springs (2) flowed until the 1930s, according to I. W. Quickel of Farwell. The lake is now on the ranch of Norvell Strawn, who has found many Indian projectile points and pottery on the hill on the east side. The springs flowed from Ogallala caliche and sand on the north side of the lake. Coronado may have stopped here in 1542 on his return from the search for "Quivira" or the Seven Cities of Gold in Kansas. The lake is now dammed, trapping surface flows on Catfish Draw. Otherwise, it would probably be dry now, as the springs no longer flow. Many ducks and other waterfowl stop here, and prairie dogs are numerous. In the southeast part of the county many other deep depressions with lakes exist. Small springs or seeps probably flowed at most of them in the past.

Quickel also remembers a spring (1), six kilometers east of Bovina on Running Water Draw, which flowed intermittently until after the very wet year of 1941. A windmill and grove of trees still mark the site, but the spring flow from Ogallala sand has ceased.

Claude Rose of Farwell remembers when cottonwood trees grew around two lakes six kilometers north-northeast of Farwell (3), until about 1950. Cottonwoods are usually a sure sign of a constant water supply. Now, however, they are gone, and the lakes are dry and cultivated.

## PECOS COUNTY

More than 10,000 years ago the numerous springs of Pecos County were frequented by a crudely equipped hunting and gathering people who used chipped stone artifacts. In prehistoric times the Jumanos were found to be living at the springs. In the eighteenth century they were replaced and absorbed by the mounted Lipan Apaches, who were in turn forced out

by the Comanches. De Sosa was guided to the county's springs by the native Indians on his journey up the Pecos River in 1590.

At that time the Pecos River was much larger than now. It was fed by numerous springs and marshy, spring-fed streams along which the rush *Juncus mexicanus* was common. Until as recently as 1870 these marshes abounded with ducks, geese, cranes, herons, water hens, partridges, perch, catfish, and turtles. Panthers, antelope, wolves, and even bighorn sheep could still be found in the county. Until the 1960s springs flowed from Triassic sandstones along the river in the northwest part of the county. The early explorers discovered the Pecos River's sediment-laden water to be cocoa-colored at times. They found that by mixing chopped prickly-pear leaves in the water, the silt could be settled out. Of course they drank clear spring water in preference to river water whenever they could find it. The river was so difficult to cross that many early explorers lost most of their stock animals in the crossings.

This situation has now changed enormously. Primarily as a result of irrigation pumping, which has consumed very large quantities of water since about 1946, groundwater levels have fallen as much as 120 meters, and nearly all springs in the county have dried up. As discussed under Crane County, the series of strong springs along the Pecos River east of Imperial has greatly decreased their discharge in recent years. The remaining ones are all beneath the river surface. The Pecos River can now be easily waded at many points.

Because of the depth from which groundwater must be pumped, rising energy costs, and increasing salinity of the water, much irrigation pumping has been abandoned. This has resulted in a slackening of the decline of the water table, but a rise of the water table or resumption of flow of the springs is not to be expected.

In the headwaters of Six Shooter, Monument, Independence, and Escondido Draws southeast of Fort Stockton the springs were always small. This is because these are areas of recharge for the large springs in eastern Terrell County. Here water moves mostly downward into the aquifer rather than outward as springs.

The county's spring waters were for the most part slightly to moderately saline, with some fresh water in the extreme eastern part. They were usually of a sodium bicarbonate type, very hard, alkaline, and high in silica. The analyses shown in the table of Selected Chemical Analyses indicate the range in values for the spring waters at a time when they were still flowing.



The writer's chief visit to the county was made during the period August 23-30, 1976.

The failure of **Comanche Springs (1-13)** was probably the most spectacular example in Texas of man's abuse of nature. Formerly these large springs in Fort Stockton flowed from a fault in Comanchean limestones at an elevation of around 894 meters. Their importance was perhaps best described by Raht (1963):

These springs, known to-day as Comanche Springs, have been through all the ages the cross-roads of the Southwest. With every changing race of people to enter the Big Bend region, these springs have been a mecca. De Vaca must have camped near them in 1535; the Jumanos, from the Rio Grande and Conchos River, made it their camp on the way to and from the buffalo country and the salt lakes; the Hau-paches, or Apaches, camped near its source on their way from their rancherias in New Mexico to raid and steal from the Jumanos and Tejas nations, living east of the Rio Pecos; in 1839, Dr. H. Connelly, with a great train of bullion, made these springs a resting-place between Chihuahua City and Arkansas, on the initial trip which opened up the great Chihuahua Trail; ten years later Lieutenant Whiting, of the U.S. Topographical Engineers, mentioned these springs, on his way from San Antonio to El Paso; and to-day they mark the site of Fort Stockton, a transcontinental automobile highway, and the line of the Kansas City, Mexico & Orient Railroad. Once a trail, always a trail.

In 1684 Mendoza and his party camped here. He wrote (Bolton, 1908):

On the 11th of the said month and year we set out from this place, which was given the name **San Juan del Rio**. It is in a beautiful plain. In its environs there are four high mesas; from the small one toward the north flows a spring; within three arquebus shots, apparently, there issue five other springs, all beautiful; and within the distance of half a league a most beautiful river is formed, although without any kind of tree, it having only camalote [water hyacinth] patches. The water is very clear, although a little alkaline [hard]; it is well supplied with fish.

Besides the name of St. John of the River, Comanche springs were later known as **Agua Ancha** (Wide Water). To the Comanches they bore the name of **Ahuache Springs**. Comanche Creek originally flowed through vast marshes of tules abounding with all types of waterfowl for about 25 kilometers before disappearing in the sand. The former marshes are still marked by dark gray soils which were once peat and muck.

The Old Spanish Trail from San Antonio to El Paso passed the springs. In 1849 the U.S. Cavalry and many gold seekers traveling to California made refreshing stops here. In 1857 the Leach wagon trail (Williams,

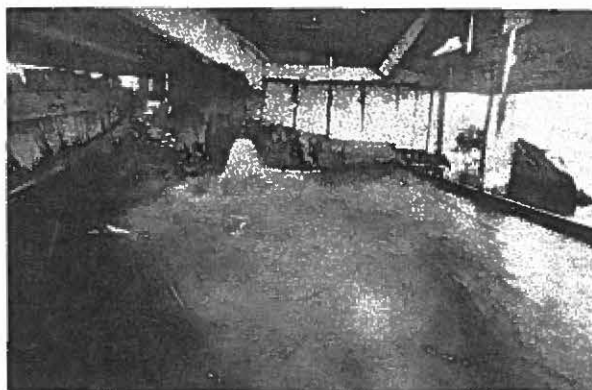
1953) described the springs as follows:

about 5 p.m. we reached Camanche Springs, a beautiful stream some ten or fifteen yards wide, about ten feet in depth, clear as crystal and running at a mill tail rate a few miles and then losing itself in the earth. Camp was ordered to be pitched here.

In 1859 Camp Stockton was established and used the spring water as its supply. In the same year the Army's experimental camel train camped here. A tunnel was dug from Fort Stockton to the springs so that water would be available in case of a siege. The abundant water cress was found by the fort's personnel to be an excellent antidote for scurvy. An 8-hectare (20-acre) garden was irrigated with the spring water to provide okra, onions, cucumbers, melons, and other vegetables to the fort. The water was delivered to early settlers from a barrel on a burro-drawn wagon. In 1904 it was used to power a gin. In 1911 the main springs were covered and used as a bathhouse, chiefly by women. A historical marker commemorates the springs.

The rare and endangered Comanche Springs pupfish lived here until the springs dried up. They still maintain a precarious existence at San Solomon Springs in Reeves County.

Comanche Springs derived their recharge from rainfall on the Comanchean limestones in the hills 25 to 50 kilometers to the southwest. From 1875 on, they were the basis for an irrigation district which watered 2,500 hectares of cropland. Heavy pumping of the aquifer for irrigation, especially in the Belding area about 20 kilometers southwest, intercepted the recharge and lowered the water table. As the graph in the section entitled "The Decline of Texas Springs" shows,



FURNISHED BY THE LATE H. H. BUTZ, A PIONEER OF FORT STOCKTON, THROUGH CLAYTON W. WILLIAMS  
Comanche Springs around 1911.

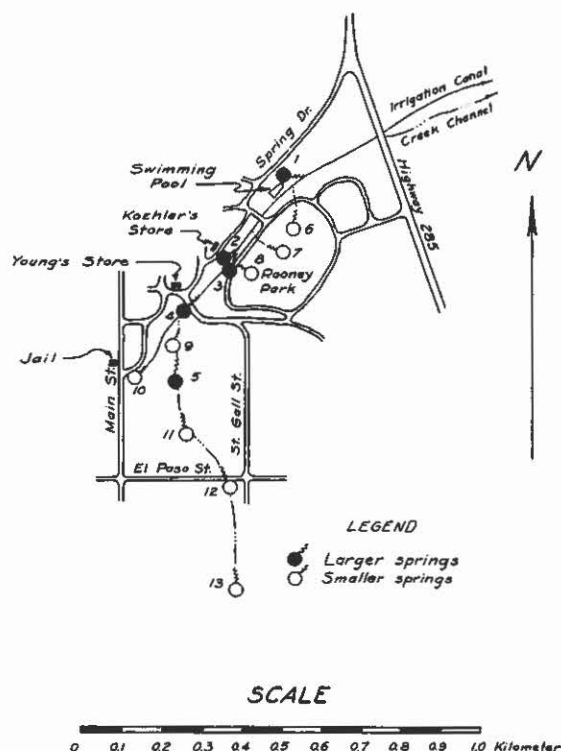


*Comanche Springs today.*

the spring discharge began to fall off in 1947, and by March 1961 had ceased. Thus, after uncounted thousands of years of beneficial use by mankind, these beautiful springs have been sacrificed in the name of *progress*. The recorded discharge, in liters per second by water years, is as follows:

1899	1,900	1944	1,200
1904	1,800	1945	1,200
1919	1,300	1946	1,200
1922	1,300	1947	1,200
1923	1,200	1948	1,000
1924	1,300	1949	1,000
1925	1,400	1950	960
1932	1,200	1951	760
1933	1,300	1952	740
1934	1,300	1953	570
1935	1,200	1954	740
1936	1,200	1955	480
1937	1,200	1956	370
1938	1,200	1957	110
1939	1,200	1958	51
1940	1,200	1959	23
1941	1,200	1961	42
1942	1,200	1962 on	0
1943	1,200		

The springs were located in the southeast part of Fort Stockton, as the accompanying map shows. No. 1, at the swimming pool in Rooney Park, were the **Main Springs**. No. 2 and 3, at Koehler's store, were also moderately large. No. 4 was near Young's store. No. 13 was the **Head Spring**, where wagon trains often camped if they were unable to cross Comanche Creek below this point. No. 12 was called **Ojo Hazeltine** or Hazeltine Spring for the owner, according to M. R. Gonzalez, a long-time resident. Similarly No. 11 was **Ojito del Moore** or Moore's Little Spring. No. 10 had the name of **Ojito del Jerife** (Sheriff's Little Spring) or **Jail House Spring**. Most of the holes and depressions from which these springs once issued can still be seen. Some are walled up with stone stairways leading down to the former springs. But something very vital to Fort Stockton has been lost. Cottonwood, elm, and salt cedar trees still stand among the former spring sites in the park.



*Location of the various Comanche Springs.*

Five kilometers southeast, on the southwest side of Threemile Mesa, were **Threemile Springs (23)**. Located at a quarry used by the fort in 1867, they have been dry since about 1905, according to Clayton Williams, a west Texas historical authority.

**Leon Springs (30)**, were 15 kilometers west of Fort Stockton and two west of Lake Leon, just south of Interstate 10 on Bobby Brown's ranch. They were another very vital stop to early Americans and later to the European explorers and settlers. Mendoza in 1684 stated, as translated by Bolton (1908),

It has as marks three small hills standing toward the west; and toward the north a cliff from which issues a spring of alkaline [hard] but pleasant water.

Mendoza called the springs **St. Francis Xavier**. They have also been known as **Ojos del Leon** (Panther Springs) and **Agua Delgado** (Soft Water, although as the figures in the table of Selected Chemical Analyses show, the water is very hard). Some early maps show **Bow Springs** in this vicinity.

The main springs originally issued from three deep

holes up to 30 meters in diameter which extended down into the cavernous Comanchean limestone. They were encircled by a mat of tule roots and other aquatic plants strong enough to support a man and extending out several meters from the edge. As indicated by historical records, aerial photographs, and the dark gray swamp soils which still exist, the springs were once surrounded by marshes which extended many kilometers downstream. The area teemed with antelope and all sorts of other wildlife. There were many other springs in the area, especially two kilometers northwest of the main springs, three southwest, and three southeast. In the limestone conglomerate east of the former main springs are a number of bedrock mortars where the inhabitants long before Mendoza's time ground nuts and mesquite beans.

The Old Spanish Trail from San Antonio to El Paso passed Leon Springs. In 1849 Lt. S. G. French of the U.S. Cavalry (U.S. Senate, 1850) described them as sinking to great depths like large wells. He described salt deposits around the springs and an odor of sulfur.

In 1857 the Leach wagon train stopped here. Their description of Leon Springs was recorded by Williams (1953):

It may with truth be said that it is difficult to convey any idea of their nature and appearance. They consist of two bodies of water welling up from the bosom of the earth forming two pools the depth of which is considered very great, but is not exactly known. The water is clear, impregnated with sulphur and very pleasant to taste. The valley in which they are located is in many places of a very miry nature and there is much danger of losing animals in the bog if suffered to go at large here. The vegetation in the vicinity is extremely rank and plainly indicative of a heavy alkaline deposit. A halt was ordered at "Leon Springs," the stock allowed such grazing as was afforded, a hasty collation partaken of, several of the water casks filled and at 3 p.m. the train was again ordered forward.

The Conklings (1947) were among the last to see Leon Springs in something of their former grandeur. In their words,

there seemed little attraction in gazing down into the dark aperture, but as the sun reached a point almost overhead, its rays projected into the dark interior like those of a powerful search light, our eyes were greeted with a sight that seemed out of keeping with our strange surroundings. For there in the constantly ascending column of now crystal clear water, we had a transient glimpse of a shoal of tiny and quite large minnow-like fish, some swimming slowly, some appearing stationary, their iridescent little bodies gleaming like jewels, transparent and radiant under the sun's rays, and forming complicated patterns like objects in a kaleidoscope. That anything so exquisitely beautiful could be amid such desolation, made the gray, haggard face of the Leon Water Hole region appear more friendly to us, as though we had been taken into its confidence and allowed this fleeting glimpse of its well-guarded secret.

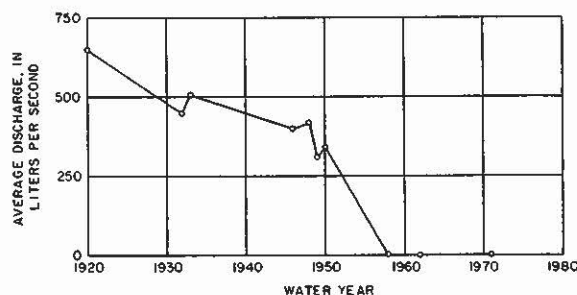
The fish which they saw were the rare Leon Springs pupfish. In 1931 a strong earthquake roiled the springs and killed some of the pupfish. They survived, only to be doomed here when irrigation pumping began in 1946. They still live in refuges at Diamond Y Springs (33) and at San Solomon Springs in Reeves County. But their future is highly uncertain, as these springs may also dry up with continued irrigation pumping from wells.

Leon Springs' flow was formerly used to irrigate 800 hectares of cropland. The springs failed in the late 1950s and the deep holes were soon filled with sediment from man-made soil erosion. Six large irrigation wells surrounding the former springs now pump water into Lake Leon constantly during the growing season. The water table has presently been drawn down to 40 meters beneath the surface. The site is overgrown with salt cedars.

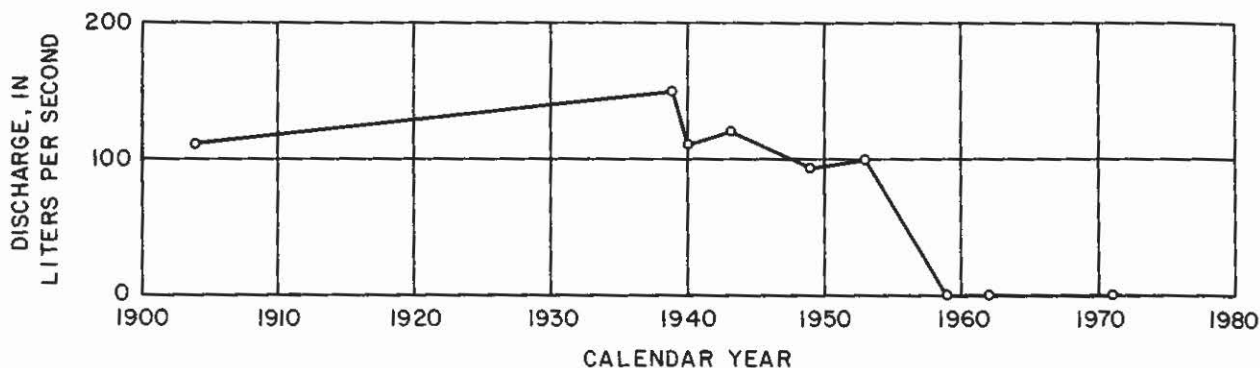
Discharge records are shown on the accompanying graph. The maximum recorded discharge was 790 lps on May 26, 1948. Some flowing wells were included in the discharge measurements.

Thirteen kilometers southwest of Grandfalls was **Santa Rosa Spring (35)**, at latitude 31°16' and longitude 102°57'. It flowed from a Comanchean limestone cavern in a ravine. The Jumanos and Apaches who formerly frequented the spring left numerous artifacts. Taylor (1902) described it as an oasis in the desert, with cottonwood trees along the irrigation ditches which watered 400 hectares of alfalfa and peach trees. Runoff water now occasionally flows into the cavern, but spring flow from it ceased in the late 1950s. Discharge records are shown on the accompanying graph.

To the south on Carl Courtney's ranch, at latitude 31°11' and longitude 102°56', are **Monument Springs (34)**. They rise from sand and organic muck in a four-hectare chain of lakes and swamps. Formerly the swamp area was about three times as large. When the



Discharge of Leon Springs.



#### *Discharge of Santa Rosa Springs*

writer visited the springs they were being cleaned out with a dozer. A flow of 12 lps was observed, but this was not sufficient to cause any overflow from the other end of the chain of lakes 500 meters downstream. Evidently seepage, evaporation, and transpiration absorb the water in this distance. In 1957 an overflow of 0.13 lps was observed. The water is moderately saline (see table of Selected Chemical Analyses), probably because the mineral content is concentrated by evaporation.

**Diamond Y or Deep Springs (33)** are the largest of the surviving springs in Pecos County. They are located 13 kilometers north of Fort Stockton on M. R. Gonzalez' property, at latitude 31°00' and longitude 102°55'. Some other springs (now dry) seven kilometers northeast of these have also been called Diamond Y Springs, but this was probably an error. Several others formerly flowed nearby.

Diamond Y Springs issue from a deep hole into Comanchean limestone about 18 meters in diameter and bordered with reeds, at an elevation of 880 meters. The upstream Leon Springs probably looked like this at one time although they were much larger. The hole at Diamond Y Springs appears to have been partially filled with sediment. This is one of the last footholds of the Leon Springs pupfish, which are studied by scientists from all parts of the country. A diversion dam has been built around the springs to prevent floods from washing more sediment into the pool. Incrustations of salt occur on the surrounding soils. These springs also were affected by the 1931 earthquake, but the pupfish have survived, at least for a few more years. The springs probably are recharged from Lake Leon, 14 kilometers upstream. Seepage from the lake probably moves down dip through the cavernous limestone to the springs. As long as the lake is there, the springs will

probably continue to flow. Discharge measurements in lps follow:

May 10, 1943	11	Jan. 1974	25
Jul. 19, 1950	41	Aug. 26, 1976	17

On August 26, 1976, a flow of 2.1 lps was also observed six kilometers downstream, at the Highway 18 crossing.

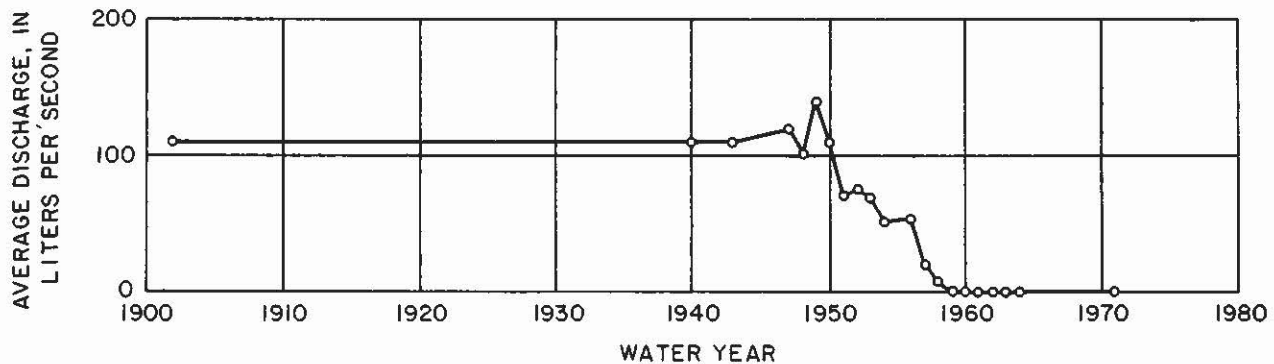
The former **San Pedro Springs (31)** are of great interest to archeologists. They are 11 kilometers north-northeast of Fort Stockton on Conoly Brooks' ranch. Frank Warnock, a former resident, has done much excavation here, uncovering the bones of an elephant, camel, extinct bison, horse, wolf, and antelope, in association with Sandia and Clovis projectile points. He believes this to be an ancient kill site, perhaps as long as 20,000 years ago. In 1684 Mendoza described these springs as follows (Bolton, 1908):

Half way we found a very beautiful spring which flows toward the north; toward the east runs a chain of mesas, on the right hand as we came. All the road is level, without stones, covered with much pasturage.

San Pedro Springs, which have also been called **Featherette Springs**, flowed from Trinity sands. Originally there was a large marsh surrounding them with good grasses. Now the former marsh is marked by gray soils, but it is dry, with only mesquite, creosotebush, and dead cottonwoods present. The head of the springs was in a ravine about eight meters below the surrounding land. At one time the water was used to irrigate 400 hectares. The remains of the irrigation ditch may still be seen.

Discharge records are shown on the accompanying





*Discharge of San Pedro Springs.*

graph. The flow ceased in April, 1958. Maximum recorded discharge was 181 lps on January 18, 1949.

Nine kilometers northeast of Fort Stockton and one west of Sevenmile Mesa, also on the Brooks ranch, were **Cold Springs (32)**. These springs flowed from Comanchean limestone and possibly Trinity sand, leaving large deposits of travertine. Here also there was a large grassy marsh originally, but chiefly mesquite now. The water was used for irrigation. On October 16, 1942, they discharged 74 lps. They were no longer flowing in 1958.

Near San Pedro and Cold Springs, mostly on the H. C. Patterson ranch, were a number of other very similar but smaller springs, all gone now. Five kilometers northeast of San Pedro was **Agua Bonita**, or Pretty Water (22), which was shown on some old maps and flowed 14 lps in 1943. Seven kilometers northeast were **San Simon Springs (18)**, at latitude 31°01' and longitude 102°47'. They produced 5.0 lps in 1943. **Adobe Springs (17)**, two kilometers north of San Simon, discharged 10 lps in 1932 and still flowed in 1943. **Travertine or Casa Blanca (White House) Springs (19)**, 2½ kilometers east of San Simon, flowed 2.8 lps in 1924 and were still flowing in 1943. **Johnson Springs (21)**, four kilometers east of San Simon, discharged 8.8 lps in 1943 and still flowed in 1957. Eleven kilometers north of San Simon were **Sulphur Springs (15)**, just west of Highway 1053. All of these former springs are still surrounded by gray soils which indicate ancient bogs. Now only mesquite and other brush are present.

**Whiskey Springs (24)** are 15 kilometers west-northwest of Bakersfield. They are on Louis Woodward's ranch on the south side of Big Mesa. In the 1920s the site became known as Whiskey Canyon when a whiskey still used the waters.

Whiskey Springs are in a deep ravine, inaccessible except in a few places because of high vertical bluffs. The bottom of the ravine is filled with large boulders with cedar, sophora, and chinaberry trees, and brush. On June 24, 1979, there was seepage into a pool. On a large flat rock at the water's edge a red coachwhip snake waited motionless for a frog to swim by. Water boatmen dart among the water milfoil. Raccoon tracks were numerous, and red-tailed hawks soared overhead.

Two kilometers northeast of Sheffield on the southwest bank of the Pecos River are **Pecos Springs (40)** on Charles Hale's ranch. These springs were very popular in past ages, as shown by the burned-rock middens, stone artifacts in nearby rock shelters, and bedrock mortars on the ridge to the south. Wild plums may still be found here, and javelinas roam the surrounding hills. The springs were a regular stage stop on the Old Spanish Trail. They were shown on G. F. Cram's 1885 map of Texas. The first white settler here was Will Smith in 1886.

Pecos Springs were also known as **Canon Springs**, after a later owner. They are walled into a pool, and were formerly used to irrigate 34 hectares of cropland. The discharge, from Trinity sand, was 20 lps on March 7, 1924, and 14 on August 17, 1943. On August 29, 1976, there was no flow over the concrete weir, but about 3.1 lps issued from smaller, lower springs close to, and in some cases beneath the surface of, the Pecos River. Nearby pumpage of groundwater for irrigation has no doubt contributed to the decline of the springs. The water has the highest quality of any spring waters in the county, with only 387 milligrams of dissolved solids per liter.

One other former fresh-water spring in this area deserves mention. This was **Cedar Spring (14)**, eight

kilometers north of Sheffield on the west bank of the Pecos on the H. M. Holmes ranch. It was shown on W. R. Livermore's 1883 *Military map of the Rio Grande frontier*. The cedar trees for which the spring was named still stand, but there is no longer any flow from the alluvial sands. The spring was much used by early settlers in the surrounding area. A well nearby has probably drawn off its water supply. Some writers have placed Cedar Spring in Crockett County.

Twelve kilometers west of Bakersfield on Tunas Creek, were **East Escondido Springs (37)**, on Tom McKenzie's ranch. *Escondido* is Spanish for *hidden*. According to some sources, Indians attempted to hide these springs from travelers. In 1867 Capt. Edward Meyer described them as follows (Duke, 1973):

fine camping ground on south side of road near the first permanent water of which there is a very large pool or lake at the base of a prominent mountain 50 yards south of Road, water clear, but has a strong vegetable taste, grazing excellent—wood very scarce.

A stage stand once stood here. The springs emerged from gravel into a deep pool which was walled in with a concrete weir at the lower end. A flow of 1.6 lps was observed in 1943. Soon After, the springs failed, and the hole is now largely filled with sediment. A grove of large cottonwoods still stands at the site, and wild turkeys frequent the environs. The water level in nearby wells is now about 10 meters below the surface.

Eight kilometers west were **Middle Escondido Springs (38)**, which flowed from Comanchean limestones on the south side of Tunas Creek on the Nutt Ranch. They also were a convenient stop for travelers on the Old Spanish Trail. In 1857 the Leach wagon train called them **Agua Escondido** or Hidden Water. In 1943 they discharged 2.8 lps, but they dried up soon after.

Four kilometers farther west and thirty-two east of Fort Stockton on Interstate 10 is a restored stagecoach station and historical marker. Five hundred meters south of the station were **Tunas Springs (39)**, named for the prickly pears which are common here. U.S. Army units called them **Pears Springs**. They were also known as **West Escondido (West Hidden) Springs**. The scarlet-flowered cactus, *Echinocereus lloydii*, has been found in Texas only on the moist rocks of the bluff above these springs. With the drying up of the springs and also because of depredations by plant-knappers, the species is now presumed to be extinct in

the state. The springs were well described by Whiting in 1849 (Whiting and others, 1938) as follows:

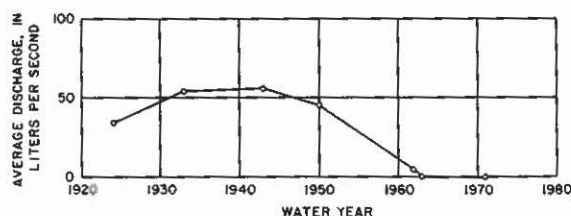
We stopped to dine hard by some excellent grass, while down in the valley below water was found in abundance. In the afternoon after passing a small thicket of hackberry we came upon a clear and beautiful spring gushing from the Limestone bluff on the N side of the valley. This is the Escondido. Here we found the grass, which had been burned off when we passed up the Pecos, green and luxuriant. . . .

Tunas Springs' water once ran a short distance and then formed a pond about 15 meters long and 3 wide. The springs were a favorite campground of Paleo-Indians, Lipan Apaches, and Comanches. On the rocky hill to the north of the springs are many flint chips, burned-rock middens, and bedrock mortars. As was usually the case, the Comanches hotly contested the white man's taking these beautiful springs from them, and numerous early travelers were killed here.

The springs flowed from Comanchean limestone at the base of the bluff. A sulfur odor was noted by some early travelers, but the water was of relatively high quality. The trace of the Old Spanish Trail may still be seen. The adjacent floodplain is irrigated with groundwater. Irrigation pumping is the most likely reason that the springs failed in 1963. Discharge records are shown on the accompanying graph.

**King Springs (36)** were 16 kilometers south of Tunas Springs on Dwaine Moore's ranch, at latitude 30°42' and longitude 102°33'. They trickled from a bluff of lower Cretaceous limestone in which there is a shelter with pictographs. Burned-rock middens nearby also testify that a prehistoric people lived at the springs. W. H. Emory, surveying for the United States and Mexico boundary in 1857, noted that King Springs were 50 miles due west of Pecos Springs, and wrote:

This is a large spring of water, deep and clear, with a fine gravel-bottom, and well protected from the sun by shelving rocks, but without a bush or tree to mark its place.



Discharge of Tunas Springs.



According to P. C. Coates, a neighboring rancher, there was some water in all of the draws in this vicinity when the area was settled in the 1880s. King Springs, which flowed from Lower Cretaceous limestones, were shown on an 1857 *Map of Texas and part of New Mexico* by the Bureau of Topographical Engineers. They should not be confused with King Springs in Terrell County.

Philip Robbins, Moore's uncle, was told by an early resident that when he came to this vicinity around 1870, there was a dripping spring at King Springs. Lime deposits on the shelter walls indicate the former presence of dripping water. On June 25, 1979, there were only pools of runoff water in the creek, in which numerous frogs swam. Killdeer fly among the chinaberry and hackberry trees.

Five kilometers southwest of King Springs on Robbins' ranch were some similar former springs (26). Here, at the head of a canyon, are pictographs in a shelter in the limestone bluff and a bedrock mortar hole. These springs also have long been dry. Cedar and hackberry trees and desert willow and algerita shrubs cover the site.

On Paisano Creek at latitude 30°52' and longitude 103°11' were Hackberry Ponds (25). These pools of live water were used by the Butterfield stagecoaches in the 1850s. In 1867 Capt. Edward Meyer wrote of them (Duke, 1973):

The Pond comprises three (3) holes on right side of road, in which, after Rains, miserable dirty water stands for a few days. Fair camping Ground just west of holes—fair grazing—wood very scarce.

The water seeped from lower Cretaceous limestones and Quaternary gravel. The holes in the creek bed are now usually very dry and covered with yellow sneezeweed flowers. Mesquite, blackbrush, and allthorn cover the area. The hackberry trees are gone. The site is on the M. R. Kennedy ranch, leased by George Asa Jones.

On Annie Hayter's ranch near the western boundary of the county and seven kilometers south of Interstate 10 were **Keechi Springs (20)**. Named for the Wichita Kichais who lived here, the springs, now dry, extended down Barrilla Draw into Reeves County. Bedrock mortars may be seen in the Cretaceous limestone, and many portable mortars or metates, manos, pestles, and flint projectile points and knives have been found here. G. F. Cram portrayed the springs on his 1885 map of Texas. Mrs. Hayter was told

by an old-time resident that Barrilla Creek and the springs flowed until around 1900.

## POLK COUNTY

Before impoundment of water in Livingston Reservoir began in 1968, archeological salvage excavations were undertaken. Caddoan pottery and projectile points, supported by radiocarbon dating, indicate that many sites in this area were occupied intermittently during the Late Archaic and Neo-American periods, during at least the last 2,000 years. It was also found that most of these sites were associated with flowing or former springs.

The springs of the county flow chiefly from Quaternary and Tertiary sands which dip gently to the south-southeast. Although there has not been a very heavy draft upon the groundwater resources, groundwater levels have declined and many springs have failed. This is probably due largely to clear cutting of forests and consequent loss of recharge capacity of the soils.

Most of the writer's field studies were made during the period August 26-31, 1975. The spring water is generally of a sodium bicarbonate type, being fresh, soft, and of neutral pH.

The Atakapan Indians plied the Trinity River in rafts and dugout canoes long before the settlers' ships arrived. When the Alabamas and Coushattas came to the area in the early 1800s they settled at the best springs and engaged in an agricultural way of life, raising livestock and cultivating corn, peas, beans, sweet potatoes, and peaches.

**Long King Springs (5)** are four kilometers north of Livingston. They flowed 1.1 lps in 1975 from sands in a terrace deposit at an elevation of about 45 meters. In 1831 the Coushattas still had a village here, with their circular houses made of poles, Spanish moss, and mud.



Long King Springs.

Their women undoubtedly carried water from these springs.

**Bold Springs (11)** are 11 kilometers west-northwest of Leggett and 500 meters east of the Bold Springs church and cemetery. They supplied water for the Bold Springs school and store as early as 1849. At that time they were much higher on the slope and only about 100 meters east of the settlement. On May 9, 1947, the discharge was 0.19 lps. On March 18, 1978, it was 0.075 from Willis sand amid many cloakfems.

Three kilometers east of Leggett are **Peach Island Springs (7)**. They trickled from Miocene Fleming sand at 0.72 lps in 1978. Six kilometers downstream the water flows past the site of the old Peach Island Indian village, where it was probably used by these people. Near here a 6-kilogram gold cross was reportedly buried with an Indian chief.

Two kilometers northwest of Corrigan, just west of Union Springs church, are **Union Springs (13)**. They are now on Champion International Corporation land. According to nearby resident Cleve Dickson, they were used by the church beginning in the 1860s. Although largely covered with sand, the springs still produced 0.82 lps on March 19, 1978 from Catahoula sand. The nearby **King Springs** are now dry.

**McGee Springs (14)** were one kilometer northwest of Corrigan, also on Champion International property. From these springs, according to Dickson, M. C. McGee once hauled water by the barrel to Corrigan. They were formerly curbed, but now are covered with sand and only seep.

**Sulphur Springs (8)** were 15 kilometers east of Corrigan on Champion International Corporation land. They issued from volcanic ash and sand in the Catahoula formation. Deussen described the water in 1914 as containing much iron and sulfur. Nearby resident Byron Pate remembers many people traveling long distances to obtain the spring water, which was thought to have curative powers. An old school also used the waters. The springs, which flowed from Whitsett sandstone, were buried during logging operations.

**Harris Springs (9)** are very close to the angle in the east county line, on Tommy Carter's land. As they are difficult to reach, it is best to obtain directions from Pate, who lives seven kilometers southwest. The old Harris homestead was at the springs. The water formerly issued from crevices in Whitsett sandstone, according to Pate, but this has now been covered and the flow exits through a pipe. Several water-loving plants thrive here, including marsh purslane, moss, and ferns. A brick fireplace has been built nearby. On March 19, 1978,

the discharge was 0.57 lps.

Ten kilometers north-northeast of the Indian Reservation are **Cooper Springs (10)** on Mrs. Bullington's property. These very small springs flow into Dickens Branch. Woods School once used their waters, according to neighbor Ray Hubert. Hunters now frequently stop here. Panthers and mixed-breed wolf-coyotes still roam the vicinity.

**Big Springs (2)** are just south of Highway 190, one kilometer from the Tyler County line. Charles Dickens guided the writer to these springs, which are owned by Champion International Corporation. Several springs formed sand "boils" where they emerged from Willis sand at 5.0 liters per second on August 30, 1975. They formerly supplied water for a school and the old Morganville settlement. Near here \$1,000 in gold and silver coins is said to be buried. Water is pumped from a similar spring north of the highway to Jack Collins' home.

**Midway Springs (3)** are located at the Midway church, about four kilometers northeast of the entrance to the Alabama-Coushatta Indian Reservation on Highway 190. Pre-Civil-War settlers used these springs before they got around to digging wells. Later they supplied the Midway church and school. They flowed 4.0 lps in 1975.

On the Alabama-Coushatta Indian Reservation, established in 1832 through the efforts of Sam Houston, are the **Alabama-Coushatta Springs (12)**. Two groups of springs may be seen on the bus tour of the reservation. Each produced 1.1 lps from Willis sand on March 19, 1978. One group, called **Living Springs**, flows through a hollow log. The other group discharges partly from a log spring box into a small pond with a shallow-water crossing. According to reservation superintendent Emmett Battise, some of the springs are still used by the Alabama-Coushattas as in the past, although the reservation's water needs are now supplied by a well.

**Indian Springs (4)** are at a real-estate development of the same name 17 kilometers east of Livingston and two south of Highway 190. They include many small springs which flow from sand in the Willis formation. Most of them are now under water in the nine lakes of the development, but fed 6.1 lps of water to the lakes on August 30, 1975. They were depicted on an 1883 map by the New York and Texas Land Company, and were well known before the arrival of European settlers.

**Drew Springs (6)** are located five kilometers south of Schwab City, at latitude 30°33' and longitude 94°49'. Flowing from Willis sand, the spring water is

extraordinarily free of dissolved minerals, approaching rain water in purity (See table of Selected Chemical Analyses of Spring Waters). The lower Coughatta village was nearby. In 1766 Marquis Cayetano Maria Rubi may have stopped here en route from Nacogdoches to Presidio Ahumada in present Chambers County. In 1838 Monroe Drew settled at Drew's Landing to the west and probably used the springs. They flowed 1.9 lps in 1975.

**Swartwout Springs (1)** were located just north of the Lake Livingston dam near the east shore. They flowed from sands at the base of a bluff of Quaternary Beaumont formation. In 1809 a Coughatta village was located just south and probably made use of the springs. In 1835 the first settlers arrived at the springs. The town of Swartwout became a thriving steamboat port before the Civil War. Historical markers are at the site. An old settler reports that the springs furnished a copious flow of "good sweet water." Since 1968 they have been under four meters of water in Lake Livingston, but may still be flowing.

Several other springs of historical significance are essentially dry now, due chiefly to falling water tables caused by well pumping and clearing of forests. These include **Darby Springs**, eight kilometers west of Darby, where the Indians used to beg for milk at the 1838 Augustus Darby place.

## POTTER COUNTY

Most of the springs in Potter County appear from Tertiary Ogallala sand and gravel which slopes gently toward the Canadian River. Many springs also issue from Triassic Dockum or Santa Rosa sandstone beneath the Ogallala, but the water originates largely from the Ogallala. Beneath the Triassic lie Permian shale, siltstone, and dolomite, which usually contain only small amounts of water. The springs occur largely in the rough "breaks" within 20 kilometers of the Canadian River.

The plains which lie on the caprock and on which Amarillo is situated were called the *Llano Estacado* by the earliest Spanish explorers. This does not mean *Staked Plains*. Rather, it has the simple meaning of *Palisaded Plains*. To the first explorers the lofty cliffs surrounding the plains resembled the palisades or walls used in fortifications. Marcy wrote in 1851, when camped in the county,

Our present position is about half a mile from the road, to the left, near the timber. It is directly in a gap or notch, formed by the bluffs of the "Llano Estacado," which here jut in very near the road, and present the appearance of the walls of fortifica-

tions, with glacis revetted with turf. There is one near our camp, detached from the main bluff, that can be seen for many miles; and as it is round, very symmetrical, and crowned with a stone cap in the form of a reversed plate, it is a good landmark.

Early Americans used the county's springs as long as 15,000 years ago. The varicolored Alibates flint, mined at quarries near Lake Meredith in the northeast part of the county, was a hot trade item. Points made of this flint have been found as far away as Montana. Clovis and Folsom men used Alibates flint spear points to kill mammoths, camels, horses, and giant bison, all now extinct. From 1000 to 1450 A.D. an agricultural people, called the Pueblo or Antelope Creek focus, took control of the flint quarries. In one of their slab-rock villages 16,000 artifacts made of Alibates flint were found. Later the Apaches, and finally the Comanches, Kiowas, and Kiowa Apaches, occupied the springs in the county.

In 1598 Juan de Onate said of the area around Potter County (Castaneda, 1936):

These cattle [bison] have their haunts on some very level mesas, which extend over many leagues... The mesas have neither mountain, nor tree, nor shrub, and when on them, [the men] were guided solely by the sun. To the north, in their highest part flows a medium-sized river, which appears to be a marvel, for at that point it is higher than at its source, and seems to flow rather up than down. At the base of these mesas, in some places where there are glens or valleys, there are many cedars, [the well known cedar brakes] and an infinite number of springs which issue from these very mesas, and a half league from them there are large cotton[wood] groves.

Lt. J. W. Abert, who surveyed the environs of the Canadian River in 1845, noted the wild plums, grapevines and hackberry trees, and the teal, brant, geese, and turkeys which haunted the spring-fed streams and lakes. Cottonwoods, hackberries, willows, grapevines, plum thickets, rushes, and cattails still adorn the springs. But the plants and animals which depend upon the springs environment are now much fewer, because the springs are weakening and disappearing.

Although Amarillo now obtains water from Lake Meredith, the city still pumps much fresh groundwater to blend with the slightly saline lake water. Irrigation as well as industrial and municipal pumping are removing far more water from the subsurface reservoir than can be replaced by natural recharge. As a result the water table in the Ogallala and Dockum aquifers is falling rapidly, and springs are drying up.

The scars of formerly severe erosion are still visible in the form of partially healed gullies. Sediment from



these gullies has choked many stream channels and buried some springs.

The water is generally of a calcium bicarbonate type, fresh, alkaline, and very hard. The content of silica or fluoride may be high.

Most of the writer's field studies were made during the period July 2-7, 1978.

In northwest Potter County four kilometers northwest of Ady is Sandoval Plaza, settled in 1876 by Casimiro Romero. It is in a remote part of the Exell ranch, well hidden on a bluff overlooking Corsino Creek. Old stone walls still stand on the Triassic sandstone cliff above a grove of cottonwoods, where beaver and muskrats work. **Sandoval Springs (13)**, upon which the early occupants relied, produced 0.72 liter per second in 1978, which ran 300 meters down the creek.

Indian Creek, a few kilometers east, is now dry. But it must have contained a reliable flow of water when the agricultural people living near its mouth built their stone houses at least 500 years ago. Sand Creek, farther east, is also quite dry now, but from 1690 to 1725 a Faraon rancheria was located here and must have had a good water supply.

Eleven kilometers east of Ady are **Quail Feather Springs (12)** on Lahey Creek. Downstream are some stone ruins left by the Puebloan people who used the springs between 1300 and 1450 A.D. Near the springs is an old stone ruin said by Teel Bivins of the Exell ranch to be that of an early settler named Baird. Adjacent to this ruin is a bluff of soft sandstone containing many historic petroglyphs including some of longhorn cattle, and the inscription *R. T. Paul 1880*. Some of the springs have dried up, but many still feed Baird Lake. On July 6, 1978, 2.7 lps passed the lake and flowed one kilometer before disappearing. The water is recharged into Ogallala sand and gravel, but issues from Triassic sandstone.

**John Ray Springs (8)** are eight kilometers west-northwest of the Highway 87 bridge across the Canadian River. They are on the Mary Fain ranch, managed by Bob Morris. They poured out 2.9 lps on July 4, 1978, which flowed two kilometers. In 1715 General Juan Hurtado was sent from Taos to punish the Faraon Apaches. He found the village with good springs and grazing, but no Indians. The village is believed to have been located farther up John Ray Creek near John Ray Butte. At that time springs flowed here, but they are now dry.

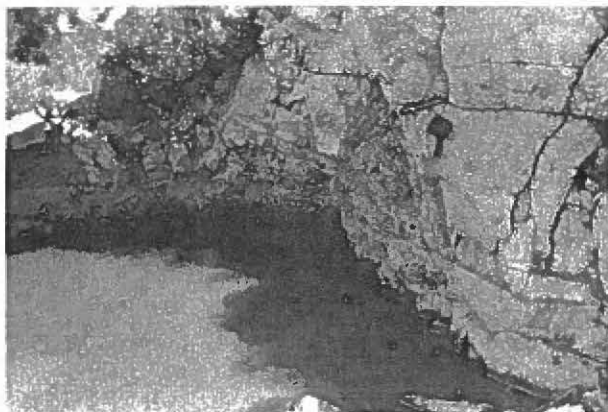
**Pitcher Springs (6)** are on Pitcher Creek just northwest of the Canadian River bridge, also on the Fain ranch. Old Pueblo ruins and an Indian burial were

found here. In 1876 the Pitcher store was located nearby. On July 6, 1978, the springs produced 3.3 lps from Dockum sandstone, which caused the creek to flow from three kilometers above the mouth almost to its mouth. Large catfish and frogs live in the pools along the creek, shaded by cottonwoods. Another spring issues in a spring box 300 meters east of the creek's mouth. Here is an attractive private park with picnic tables. Beneath the bridge on the north side of the Canadian River is still another small spring. Formerly issuing from a pipe in the rock wall, it was a very popular stop for travelers. Now it is only a seep.

Twelve kilometers north of the Canadian River bridge were **Cedar Springs (9)**. They were on the Harold Dunn ranch operated by W. R. Felts. Abundant Alibates flint flakes indicate that this was a popular living site thousands of years ago. More recently, the water was pumped to the nearby Line Camp house. In 1937 the springs were pumped 0.79 lps for 40 minutes with a 0.46 meter drawdown. They flowed from Ogallala sand on Alibates dolomite in a boulder-strewn canyon, but are now dry. Hackberry trees and grapevines are numerous, but the cedars are gone.

Seven kilometers north-northeast of the Canadian River bridge are **Tin Cup Springs (7)** on Tom Kritser's ranch. According to Monty Audrain, who guided the writer to them, they stopped flowing around 1975. Now there are only pools of seep water from Ogallala sand on Alibates dolomite. Many Indian artifacts found here disclose that the site has long been a popular spot. An old stone ruin is located downstream. Some seepage still feeds Sloan Lake, which contains very clear water and many fish. The tin cup still hangs on a hook on the rock bluff next to the former springs. West of Tin Cup Springs Creek is Ranch Creek, where other lakes are fed by springs. Two kilometers east-northeast of the Canadian River bridge are the small **White Tail Springs**, which feed a stock pond.

**Alibates Springs (3)** are 13 kilometers south-southwest of Fritch on the Coldwater ranch, managed by Rusty Tinnin. A wagon train of settlers is said to have been killed here by Indians defending their land. In 1853 Lt. A. W. Whipple, of the Corps of Topographical Engineers, camped on Alibates Creek. On July 7, 1978, there was a large natural pool with no outflow, containing water milfoil, fish, and turtles, and surrounded by Queen Anne's lace flowers. According to foreman Tim Kegans, Alibates or Bates Creek flows about two kilometers downstream in winter. Ed Day of the National Park Service says that until about 1963 there were also springs four kilometers downstream. Bedrock mortars or grinding holes and petroglyphs



*Tin Cup Springs.*

were found here. Short Creek in the northeast corner of the county has similar springs.

Sixteen kilometers southwest of Fritch are **McBride Springs (1)**. Here David McBride settled in 1898, later building the stone house which bears a historical marker. On July 7, 1978, the springs emerged from Ogallala sand on top of Permian shales, producing 0.55 lps and flowing 500 meters, but no longer reaching the ranch house. Water striders and turtles occupy the pools, and raccoon tracks are numerous among the salt cedars and plum thickets.

**Coetas Springs (20)** feed Coetas Creek about 14 kilometers east of the Canadian River bridge. Also on the Coldwater ranch, they produced 7.5 lps four kilometers from the mouth on July 7, 1978, from Ogallala sand. The water plunges over an outcrop of Alibates dolomite in a beautiful setting. Antelopes and killdeer are common. Paul and Pierre Mallet may have paused here in 1739 while traveling down the Canadian River.

**Chicken Springs (21)** are the source of Chicken Creek 13 kilometers east of the bridge. They emerge partly on the Coldwater ranch and partly on Miles Childers' LX ranch. At one time there was a natural lake here. As described by the *Amarillo Northwest* in 1891,

Chicken Lake is crystal clear and alive with fish while its boiling springs throw white sands into huge mounds on its margin.

The lake has now been filled with sand. But the springs still pour from Ogallala and Dockum sands. Minnows play among the rushes and cattails. Discharge records in liters per second by water years, near the

mouth of Chicken Creek, are:

1953	27	1966	33
1954	57	1967	21
1955	74	1968	30
1956	96	1969	28
1957	48	1970	23
1958	57	1971	51
1959	42	1972	32
1960	41	1973	24
1961	63	1974	18
1962	31	1975	31
1963	34	1976	31
1964	32	1977	34
1965	30	1978	34

Several springs feed Bonita Creek, which lies about 14 kilometers east-southeast of the bridge. Most are on the LX ranch. Near the mouth small springs (14) formerly flowed in a stone springhouse, but are now dry. The small **Bullfrog Springs (15)** are four kilometers south of the creek mouth. **Bonita** or **Pretty Springs (16)** issue seven kilometers from the mouth and flow to Lake Meredith. They produced 4.6 lps from Ogallala and Triassic sands on July 4, 1978, more in winter. Minnows dart among the rushes and arrowhead plants here. In 1851 Marcy described the creek as follows:

We started this morning, our road continuing over the elevated plateau, destitute of water, until we reached here, where there is a fine spring creek, with a great abundance of wood and grass. Our march was fourteen and three quarter miles; and this position must be reached, as it is the first camping place after leaving our camp of last night. We are at this point about eight miles from the Canadian. We have several varieties of wild fruit upon the creek near our camp; among others, grapes and gooseberries. There has been but little game seen for the last three days. I killed a turkey this evening, which is the first we have seen for a week. Quails or partridges are found at all places upon our road.

**Box Canyon Springs (17)** are five kilometers farther upstream (south-southwest) on Bonita Creek. They were a popular living site of Indians, who left pictographs on the sandstone cliffs. In 1853 Lt. A. W. Whipple described the site (Archambeau, 1971) as follows:

The beautiful rivulet upon which we are encamped is a flowing stream, bordered with trees, and fertilizing an extensive valley.

Our predecessors here were Comanches. The Teguas say that they left twenty days since, either for a buffalo hunt or war. There appear to be not less than three hundred deserted lodges; indicating a party of six hundred warriors. A thousand horses must have grazed the valley; and our mules would

have but a scanty pittance, unless driven a mile or two down the stream. The lodges are temporary bowers, made of branches planted in the ground. The form is that of a horse-shoe, and the twigs are twined at top, affording a space inside to stand or lie screened from the sun. They appear scattered at random; but, without exception, face the north. Beside each wigwam are the remains of a small fire. This camp ground covers several acres upon either side of the stream.

The spring waters run about two kilometers down the creek in winter, less in summer. Many school picnics have been held here.

Farther west, five kilometers southeast of the Canadian River bridge, were **Bog Springs (18)**. They are now only a hole of standing water in a swale of rushes and cattails, fringed with cholla or tree cactus.

The headwaters of East and West Amarillo Creeks in Amarillo formerly were fed by numerous springs (19). In 1887 these head springs were considered as a site for the county seat. In 1888 the Amarillo Champion, recommending stock pens one mile west of Amarillo, near the present Georgia Avenue and West First Street, stated that within two miles of this location there were 100 springs in East and West Amarillo Creeks. One, on Highway 1719 near the Tascosa Country Club, still flowed in 1937, supplying 100 head of cattle. These springs are all dry now, but surplus water is sometimes pumped into East Amarillo Creek from T-Anchor, Wild Horse, and other lakes in Amarillo.

**Two Tree Springs (4)** were in the Rolling Hills subdivision of Amarillo. In 1937 they still flowed and fed a small lake, since washed out. The former swimming hole behind W. Henderson's residence at 400 Ramada Trail is only a mud hole now. The pond on the creek behind Mrs. M. G. Elkins' home at 115 Renegade Trail frequently dries up. A few cottonwood trees still survive. Each home has its own well. Pumping from these many wells has undoubtedly greatly lowered the water table.

**Spring Grove Springs (5)** were located along West Amarillo Creek near Cliffside. Water still seeps from Quaternary alluvium and Dockum sandstone to form pools of water which cattle drink. In winter, according to long-time resident Mrs. M. N. Twaddell, the creek usually flows at Cliffside. In 1840 trader Josiah Gregg and his wagon train camped at the springs. In 1853 Lt. Whipple wrote of this place:

Having travelled twenty miles, we encamped at Beautiful View creek. Water is plenty in pools, but wood scarce. The grass, though dry, is abundant. We have again met buffalo signs.

In 1891 the Spring Grove school was located nearby. Cottonwood trees still extend up the creek past Cliffside.

At the headquarters of Stanley Marsh's Panhandle ranch, formerly the Word ranch, eight kilometers north of Bushland, there were springs in 1881 which usually contained snakes. It was often necessary to empty the barrel which collected the spring water to get rid of the snakes, and then allow it to refill. Many snakes still frequent **Snakey Springs (11)**, whose waters are diverted past the ranch house where they are used. On July 6, 1978, 1.7 lps issued from Ogallala sand on Triassic sandstone amid much water cress, arrowhead plants, and wild plum bushes. Jessie Kinsey, wife of foreman Marion Kinsey, was making that delicious plum jelly at the time of the writer's visit.

**Las Tecovas or The Lodge Skins Springs (10)** are on Carolyn Emeny's Frying Pan ranch, managed by Robert Groves. They are near the ranch headquarters nine kilometers northwest of Bushland. A historical marker concerning the springs is located 1.6 kilometers east of Bushland. This was a favorite campsite of prehistoric people, and of traders, military parties, and hunters from the time of Spanish explorations in the 1700s. Later they were a meeting place for smugglers and renegade peddlers called Comancheros. In 1840 Josiah Gregg's trading caravan stopped here. In 1882 a dugout home was located at the springs. A stone plaque on the springhouse states that the first election in Potter County was held here in 1887. (See Plate 4, f).

In 1881 Tecovas Springs were reported to produce 32 lps. In 1923 they were still said to be the strongest in the county. On August 13, 1924, the discharge was 2.8 lps; on April 20, 1937, it was 0.63 lps; and on July 6, 1978, 2.5 lps. The springs issue from Ogallala sand on Dockum sandstone at an elevation of about 1,105 meters. Black soils surrounding them indicate that a large swamp once existed here. A hydraulic ram is still used to pump water to the house. The springs also feed a downstream stock pond. Water snakes and fish live in the water-cress-covered pools.

## PRESIDIO COUNTY

The town of Presidio boasts of being 10,000 years old. This is probably true, although it is likely that it has been inhabited only intermittently. At any rate, from very early days there were people living in the county and making good use of the plentiful springs. In 1535 the lost De Vaca and his companions found the handsome Patarabueyes and Jumanos growing corn,



melons, squash, beans, and pumpkins along the Rio Grande. Other explorers, including Spaniards capturing Indians for use as slaves in the silver mines, soon followed, camping at springs whenever possible.

It is generally agreed that water levels in the county have fallen considerably in recent years. This has been caused by well pumping, overgrazing, and damage to recharge areas. Falling groundwater levels have of course caused most springs to decline or fail. In the mountains, springs have been least affected, but even here great damage was done to the recharge capacity of the soils by the cattle barons of the latter half of the nineteenth century.

Overgrazing is not a thing of the past. Much of the range land in the county will support only one animal unit per 48 hectares. Far more cattle than this have been traditionally crowded onto the range. During the drought of 1977-78 many ranchers found it necessary to burn the spines off prickly-pear cactus and feed it to the livestock. Sotol bulbs were also chopped out and fed to the starving cattle. Any blade of grass that showed itself was immediately devoured. In September, 1978, rains of up to 18 centimeters temporarily restored many springs.

Mae Howard Adams of Marfa lived on the Big Bend ranch before 1910. She remembers the grass as belly-high on the cattle, and springs everywhere. Flint projectile points were so numerous they were often discarded.

In most cases the water is of a sodium bicarbonate type, and is fresh, moderately hard, and alkaline. Many of the analyses shown in the table of Selected Chemical Analyses are from Christopher Henry's 1976 study. Very small quantities of uranium have been found in some spring waters, such as those of Ruidosa Hot and Bear Springs. Mattison and others (1978) found 0.6 milligram of strontium per liter in Ruidosa Hot Springs water.

The writer's studies of the county's springs were made chiefly during the period July 18-27, 1976, with some later visits. As rains had been abundant during the preceding two weeks in 1976, the spring discharges found were probably above normal for this season.

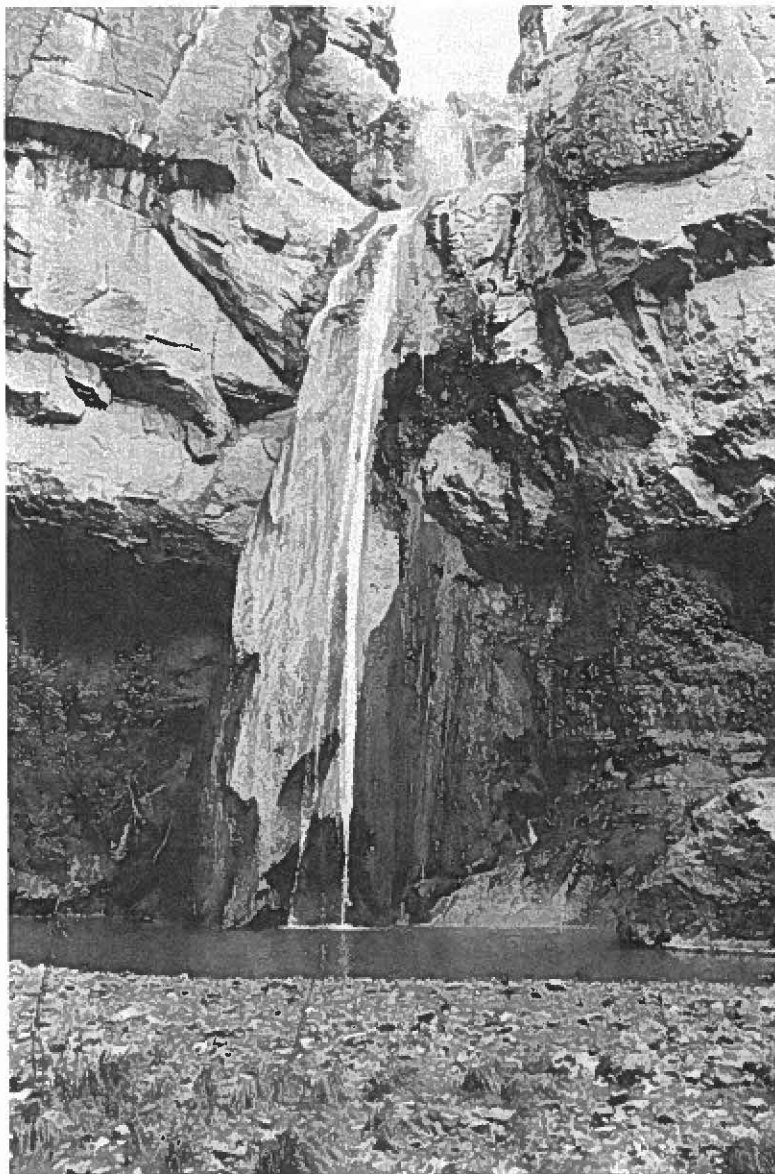
**Capote Springs (1)** are located in one of the most remote areas in Texas, 18 kilometers northeast of Candelaria and south of Capote Peak, at latitude 30°15' and longitude 104°33'. Several springs flow from Quaternary gravel in a bog or cienaga at the old Cienaga ranch house two kilometers north of Capote Falls on Jim White's Brite ranch. Several dams have been built in the arroyo below the springs, all to be

broken by floods. Severe trenching has also occurred in the alluvium above the falls, probably caused by overgrazing.

The area below the falls is leased by the Sul Ross geology department for exploration and educational purposes. The falls can be approached from below to within three kilometers with a four-wheel-drive vehicle. They make a spectacular drop over a 55-meter-high cliff of Bracks rhyolite in the Vieja Rim. It is hard to believe that in this arid area they never fail. At least up to the present time the springs have maintained the falls. On July 20, 1976, there was a flow of 6.8 liters per second.

There is a very large buildup of travertine below the falls in the shape of a cape; hence the Spanish name *capote*. In modern times man-induced floods carrying large amounts of rock have destroyed part of the capote and largely filled the splash pool with gravel and cobbles.

*Capote Falls.*



Ferns adorn the cliffs, surrounded by a grove of Arizona ash. The very rare and acutely endangered Hinckley columbine is found in Texas only at Capote Falls. The many-stem spider flower, also very rare, has been found in Texas only in the swamp at the springs. Animal life at the falls includes the canyon tree frog, the unisexual whip-tail lizard, the ornate whip snake (unique to Capote Falls), and the rare mastiff bat. The writer saw a small coyote drinking from the pool.

Nearby rock shelters show evidence of ancient human habitation in the form of prehistoric pictographs and bedrock mortar holes. Opal is common in the vicinity.

Two kilometers northwest of Capote Falls are the freshwater **Vasquez Springs**, which flowed 0.22 lps in 1974.

Two kilometers southwest of Capote Falls are **Capote Warm Springs (2)**. They are located at a very similar cliff of Bracks rhyolite, but in this case 1.5 to 6.7 lps of fresh water flows from fissures in a fault near the base of the rhyolite rather than originating above it as at Capote Springs. The warm water has a temperature of 37° Celsius. Some old ranch ruins are nearby. Ferns and columbine drape the cliffs. Wildlife is abundant, and such rare species as the black-hooded snake and rose-throated becard have been sighted here. The spring water is pumped up over the high cliff for stock use.

Ten kilometers northeast of Ruidosa are **Ruidosa (Noisy) Hot Springs (3)**. The springs are fed by surface-recharged waters that circulate to moderate depths, become heated, return to the surface through a fault zone, and emerge from Quaternary conglomerate and sandstone. The Mendoza-Lopez expedition probably camped at these springs in 1684. In 1747, according to Castaneda (1936), Captain Joseph Idoyaga visited them. In Castaneda's words,

They were now in the vicinity of present day Ruidosa. This conclusion is borne out by the fact that the next day, December 19, continuing along the river, they came upon a group of hot springs about two leagues beyond, which they mistook at first for smoke. The water was so hot that no one could hold his hand in it for more than a minute. Now it happens that a short distance above Ruidosa there is a creek called Hot Spring Creek to this day, which in all probability was the one visited at this time.

In 1849 William Whiting, of the Corps of Engineers, found many antelope at Ruidosa Hot Springs. Discharge measurements in lps follow:

1937	2.8	Jul. 20, 1976	0.95
Jun. 10, 1974	2.0	May 16, 1978	2.0
Nov., 1974	2.3		

There are also springs of cold water in the adjacent Hot Springs Creek which produced 0.35 lps on May 16, 1978. John and Lillie Tumman, who operate the resort for Bee Paul, state that the flow is usually stronger in the morning. This phenomenon is probably related to evapotranspiration, which increases in the hottest part of the day.

The water temperature of Ruidosa Hot Springs is 45 to 46 degrees Celsius. This temperature indicates that the water originates about 800 meters below the surface. People come from a wide area to relieve aches, pains, and various diseases by bathing in and drinking the water. A few cabins in a cottonwood grove are available for those using the water. As shown in the table of Selected Chemical Analyses, the water is not highly mineralized, containing only 546 milligrams of dissolved solids per liter.

Several other small springs appear in this area. **Torres (Towers) Springs (25)**, three kilometers east of the village of Ruidosa on Boundary Creek, discharge 1.7 lps through a pipe placed into the seep area by local residents. Several families haul this water to their homes. **Shannon Spring (27)** is four kilometers southeast of Ruidosa, **Ojo Jardin (Garden Spring) (26)** is 14 east, **Indian Spring (28)** is 15 southeast, and the very small **San Jose Spring (29)** is 15 kilometers south-southeast on the river road. **La Cienaga (Swamp) Springs (73)**, five kilometers northeast of Ruidosa, discharge 6.7 lps.

Eight kilometers east of Candelaria are **Nixon Springs (33)** and three kilometers farther north are **Mexican, Adobe Ruin, or Alamo (Cottonwood) Springs (32)**. Both groups, on Jesse Vizcaino's ranch, were depicted on an 1895 Geological Survey topographic map. Nixon Springs produced 2.0 lps of warm (32°C) water on June 10, 1974, and 1.1 on May 16, 1978, after much dry weather. They issue from Tertiary gravel on igneous extrusive rocks amid many yellow rock nettles, and flow about one kilometer downstream. Many metates and manos have been found here. Nixon Falls are a pour-off over the cliff above the springs which flows only during periods of storm runoff.

Alamo Springs poured out 3.5 lps on June 10, 1974, and 0.18 on May 16, 1978. They appear along several dikes which cut Tertiary Shely tuff. Julio Vizcaino, who guided the writer to the springs, pointed out several bedrock mortars nearby. An old stone-house ruin stands adjacent to the springs. Several dead, fallen cottonwood trees lie nearby. Only mesquite trees survive now. Back swimmer bugs cavort in the pools. The water is slightly warm (25°C).

**Naegele Springs (34)**, also called **Brooks Springs** on some old maps, are six kilometers north-northeast of Ruidosa on the Donald Goodrich ranch. Flowing from Quaternary sandstone, the water is used by the ranch headquarters. The discharge was 5.0 lps on June 9, 1974, and 1.9 on May 16, 1978, flowing about 100 meters downstream before disappearing. The water flows through a pond shaded by cottonwoods and willows. Cattails, pennywort, and ferns fringe the stream.

Other very small springs in this area include **Rancho (35)**, **Ranchito (Little Ranch) (36)**, **Sanguijuela (Leach) (38)**, and **Las Cachanillas (The Little Parrots) (39)**. Near Las Cachanillas Springs in Pinto Canyon have been found several crown-polished boulders, where people of past millenia worked animal hides.

Another **Las Cienagas (37)** produced 1.8 lps on June 9, 1974, in a large swampy seep area five kilometers southeast of Candelaria. Five kilometers west-southwest of Candelaria in Mexico are the very hot (90°C) **Ojos Calientes**. **Rancho Cipres**, another warm (35°C) spring in Mexico, is 21 kilometers south of Ruidosa.

Some 28 kilometers southwest of Valentine, in an area where one can really get away from it all, are **Newman Springs (6)**, at latitude 30°26' and longitude 104°44'. The road down to these springs from Chispa siding follows in places the grade of a railroad built in 1896, including a tunnel two kilometers north of the springs. The railroad was built to haul coal from the San Carlos mines, but it was soon discovered that there was very little coal there. The mines and railroad were abandoned, and the railroad ties were much used for building fences and homes in the area.

Newman Springs, three kilometers southwest of the mines, were at the site of many miners' homes. Adobe ruins and a cemetery may still be seen here. The springs produce fresh water from the upper Cretaceous San Carlos sandstone along a fault, at 0.25 lps in 1974 and 0.45 in 1976. Now on Clarence Chandler's ranch, they are walled up in a cavern in the hillside and used for stock and domestic purposes.

Five kilometers west is **Quinn Camp Spring (40)**, which produced 0.19 lps of fresh water in 1976. Six kilometers south-southwest of Newman Springs, in Blacks Canyon, are **Sitter Springs (41)**, producing 0.25 lps of fresh water in 1976. Other small and very small springs in the Sierra Vieja Mountains and their

discharges in lps as of June, 1974 are:

White (42)	0.22
Coldwater (43)	0.54
Widow (50)	0.16
Musgrave	1.4
Loveless Headquarters	1.1
McComb	0.95

Musgrave Spring is three kilometers southeast of Coldwater Spring, Loveless Headquarters Spring is five kilometers south-southeast, and McComb Spring is six kilometers south.

On the west side of Vieja Pass, 20 kilometers southwest of Valentine, are **Bear Springs (7)**, at 30°32' latitude and 104°42' longitude. Livermore and Butterfield showed them on their military map of 1881. Here, far from the "madding crowd" except during deer-hunting season, lives the recluse Evans Means. Several springs covered with arrowhead plants produced 1.9 lps from joints in a rhyolite bed in 1976. The fresh water flows about one kilometer before disappearing. The water is used to irrigate a garden and pecan and pomegranate trees. A panther was recently killed here after it had killed a colt. Geodes and agate are plentiful. Other small springs in the area include the intermittent **Soldier Springs** five kilometers southwest and **Painted Springs** 15 kilometers west. On July 22, 1976, Van Horn Creek was flowing up to 1.6 lps in places, but in many reaches the flow was beneath the gravel and cobbles of the streambed.

On the east side of Vieja Pass in Z. H. or Holland Canyon are **Ojos Viejitas** (Little Old Woman Springs) or **Canyon Springs (8)**, 17 kilometers west-southwest of Valentine. Here many freshwater springs issue from lava flows at elevations up to 1,570 meters on Clay Miller's ranch. They poured out 22 lps in 1972 and 2.5 in 1976. The buildings of Fort Holland, active from 1918 to 1923, still stand at the springs.

Here too, is a granite marker commemorating the last Indian battle in Presidio County, in 1880. Many projectile points, metates, and manos attest to the springs' long use by prehistoric people. Bigtooth maple, Arizona ash, Lombardy poplars, oaks, desert willows, grapevines, and much wildlife surround the springs. The water supplies the needs of the entire ranch.

**Antelope Springs** or **Ojos del Berrendo (4)** were located 17 kilometers southeast of Marfa on Ritchie Reynolds' ranch, at latitude 30°12' and longitude 103°55'. The springs, dry now except for some pools of standing water, flowed from Quaternary caliche rock at an elevation of 1,430 meters. The Mendoza-Lopez expedition of 1684, it is generally



agreed, stopped here. Their description of the site follows (Bolton, 1908):

Midway there are some little pools of brackish water. All the land is level. In the neighborhood of the little pools there is a great quantity of white and yellow mesquites. In the midst of so much evil there is a little spring of fresh and kindly water, and, as an exquisite thing, I had it noted with particular care. On the top of some rocks near this little spring I had a holy cross placed.

The demise of Antelope Springs probably began in 1884, when T. C. Mitchell began to badly overgraze the area. With the coming of each spring, thousands of cattle would trample the area for miles around the springs, killing the grass. This destroyed the natural layer of organic mulch which formerly held the rainwater until it could be absorbed into the subsurface. A windmill well which was later installed at the springs also contributed to their failure. A grove of large cottonwoods still stands at the site, and antelope are coming back under controlled hunting.

Eighteen kilometers south of Marfa, downstream from San Esteban dam, were **San Esteban Seeps (5)** on the W. B. Blakemore ranch. Here Kirkland and Newcomb (1967), in a shelter under a cliff on the east wall of the canyon, found some historic pictographs, including a drawing of a horse and rider. The writer and his wife were guided to the site, on the east side of the Santa Fe Railway, by Casey Stewart, son of ranch manager Donny Stewart. Many of the paintings can still be seen. The water seeps from Tertiary Mitchell Mesa rhyolite, forming a travertine deposit on the cliffs.

Early Americans who lived at San Esteban made ollas or pots from this soft travertine before they learned to make ceramic pottery. This was a stop on an old Indian trail from *La Junta de los Rios* (Presidio) to Comanche Springs at Fort Stockton, later used also by several explorers. On some old maps the seeps were called **Tinaja (Waterhole) de San Esteban**. Freighter August Santleben stopped here in 1869, calling them **Tinacha San Stevens**. The seeps now maintain a pool 15 meters in diameter containing frogs and edged with maidenhair ferns. Deer and bobcats frequent the site, shaded by pecan and hackberry trees.

At the ghost town of *Plata* (Silver) there were formerly springs (52) which were used by early explorers traveling up and down *Alamito* (Little Cottonwood) Creek. The springs are now gone, but a well flows. Steam locomotives formerly obtained water here. A small park with picnic tables and a fireplace is located at

the springs site. The flowing well fills cattail-fringed pools. Deer and beavers may be seen here. Redbirds and yellow-breasted kingbirds live in the cottonwoods. Many other small springs along Alamito Creek are marked by willow and cottonwood clumps. But irrigation on upper Alamito Creek threatens to dry them up.

Fourteen kilometers southeast of Plata on Clegg Fowlke's San Jacinto ranch were **San Jacinto Springs (61)**. They were depicted on an old Texas General Land Office map of Presidio County. Appearing near the top of San Jacinto Mountain from Tertiary basalt, they now seep only in wet weather.

Eight kilometers farther southeast on the Fowlkes ranch are **Perry Springs (62)**. Located in the rugged Middle Canyon on Dogie Creek, a rock shelter here was once the site of an Indian camp. The Seminole trail passed nearby. The springs appear on several old maps. Seeping from Eocene Duff basalt, the water on May 13, 1978, was sufficient to maintain a pool 15 meters in diameter surrounded by trees below the cliff. An old windmill was built hanging over the cliff so as to pump water from the pool below.

On Ted Harper's ranch, seven kilometers southwest of Plata, are **Sauceda (Willow Grove) Springs (17)**. Here several springs produced 0.75 lps on July 18, 1976, from igneous rocks in a grove of willows, pecans, and cottonwoods. Pancho Villa is reported to have visited them.

Farther downstream, 10 kilometers southwest of Casa Piedra (Rock House), are another **Alamo** (Cottonwood) or **Alamito Springs (18)**. These springs, also on the Harper ranch, were used by the Indians to irrigate crops long before the Europeans arrived. They later became a favorite stop on the Chihuahua trail. The ruins of John Davis' 1870 ranch house, a cemetery, and a walled-in pool at the springs may still be seen. The fresh water flowed 1.9 lps in 1976 from several springs in faulted Perdiz conglomerate and Rawls basalt. Six kilometers northwest are the smaller **Ranchito Springs**, probably the same as **Ojo Alluria** on A. W. Spaight's 1882 map of Texas.

Sixteen kilometers southeast of Casa Piedra near the Rawls ranch headquarters are **Old Ranch Springs (60)**. They now flow only about 0.03 lps from massive Rawls basalt in Old Ranch Canyon. Many chalcedony and flint projectile points and metates, now at the ranch headquarters, were found at these and other springs nearby, some now dry. Pools shaded by desert willows provide a haven for deer, quail, doves, and bluebirds. Old rock and adobe ruins at the springs date from the 1870s, according to Jack Rawls. Feliciano Mata and a Mr. Hernandez were among the early settlers here.

Eleven kilometers south of the Rawls ranch headquarters are **Alazan (Sorrel) Springs (65)**. They produced 0.10 lps in 1976 from Rawls porphyry.

Southeastern Presidio County is quite isolated. Here the natural flora and fauna, and the springs upon which they depend, have been disturbed less than perhaps anywhere else in the state. The rare perennial *Machaeranthera gypsophila* displays its white and yellow flowers. Other plants such as columbine, maidenhair ferns, Gregg ash, and Mexican buckeye survive near the springs. Cougars and bears occasionally enter the area from Mexico. The broad-tailed hummingbird, prairie falcon, Mexican bats and beavers, muskrats, and several rare species of snakes may be seen. At least three dozen archeological sites have been found in this vicinity.

The huge Big Bend ranch, owned by the Diamond A Cattle Company and managed by Ralph Hagar, has made good use of the scarce groundwater supply in southeastern Presidio County. Its headquarters are at latitude 29°28' and longitude 103°57'. At one time more than 1,100 kilometers of pipeline were used to distribute the water from many springs and a few wells over the ranch. But, as Dwight Deal (1976) says:

A number of new water wells have been drilled . . . in the past few years, but it is too early to determine what effect they will have on the springs. It is clearly a fact that the wells and the springs draw their water from the same bucket, and that bucket is refilled ultimately, from rain that falls in the recharge area. Continued development of water wells and withdrawal of ground water from the aquifers will eventually reduce spring flow.

**Alameda (Cottonwood Cove) Springs (63)** are 17 kilometers northwest of the Big Bend ranch headquarters, on Tomeros Creek. They are partially on John Rice's La Mota ranch. On May 17, 1978, 3.2 lps of water containing 253 milligrams of dissolved solids per liter discharged from faulted Oligocene Rawls porphyry. It flowed about 1.5 kilometers downstream before sinking into the gravel. Killdeer fly among the cottonwoods and desert willows. Frogs croak in the pools fringed with pink gilia and yellow desert Bailey flowers. The small **Botella (Bottle) Springs** supply the Botella camp three kilometers west of Alameda Springs.

**Cuevas Amarillas (Yellow Caves) Springs (14)** are 15 kilometers west of the headquarters. Nearby caves in Rawls tuff harbored early Americans in past millenia. Cave drawings, smoky roofs, and grinding holes under overhangs and in caves are numerous. On

May 14, 1978, after much dry weather, the discharge was 1.3 lps. **Agua Adentro (Inner Water) Spring (15)**, 11 kilometers west of the headquarters, usually produces about 0.30 lps.

At the headquarters of Big Bend ranch are another **Sauceda Springs (16)**. These springs usually produce around 0.20 lps, but on May 17, 1978, they were dry. Other small springs in this area include **Laeva Spring**, two kilometers north of the headquarters, and **Ojo Escondido** (Hidden Spring) four kilometers northeast.

Eight kilometers east-southeast of the headquarters is a group of intermittent springs on Fresno (Ash) Creek called **Old Log, Ganon, and Burro Seeps**. Here are 18 bedrock mortars, with rock shelters containing pictographs nearby. All of these seeps issue from volcanic rocks or from the gravel bolsons which fill the valleys. Rare agate and chalcedony specimens abound.

Mexicano Falls are 10 kilometers southeast of the Big Bend ranch headquarters on Arroyo Segundo. These beautiful, high falls are fed by a number of upstream springs, including **Ojo Mexicano (68)**, four kilometers west and **Chilicote Springs**, two kilometers north-northwest. They issue from porous members of the Rawls porphyry. A massive lava flow forces the water to the surface and forms the lip of Mexicano Falls. The water usually flows one kilometer downstream before sinking into the gravel. Near **Mexicano Springs** are several rock shelters containing bedrock mortar holes and pictographs, some from historic times.

Five kilometers farther downstream in Fresno Canyon are more springs called **Ojo Johnny**, only a seep on May 15, 1978.

Two kilometers farther are **Smith Springs (67)**, behind the abandoned Smith ranch house in a canyon at latitude 29°23' and longitude 103°53'. This ranch was founded in 1881 and later taken over by D.H.S. Smith. Remnants of the old pipeline which once brought water from the springs to the Smith Ranch headquarters may be seen. On May 15, 1978, the discharge was 1.3 lps.

**Madrid Springs (56)** are 1.5 kilometers southwest of Smith Springs. They pour from porous zones in basalt porphyry lava flows in the Rawls formation. A short distance downstream in *Chorro* (Spout) Canyon they form the breath-taking upper and lower Madrid Falls, 30 and 10 meters high. Here the writer found a Plainview point made of Alibates flint, possibly 11,000 years old. These springs must have been a popular place even then. (See Plate 6, d).

C. H. Madrid settled at Madrid Springs in the 1870s,

and used some of the spring water to irrigate an orchard of peach, orange, and fig trees. The old house still stands. On May 15, 1978, the discharge was 1.4 lps, which ran 500 meters before disappearing.

Eight kilometers northeast of Smith Springs, in the geologically unique Solitario uplift, are **Lower Shutup** or **Three Springs**. Trickling from Miocene volcanic tuff, they are intermittent, usually producing less than 0.06 lps. Nearby is a smoke-blackened rock shelter with a small bedrock mortar.

**Trough Spring** is five kilometers southeast of Smith Springs, just south of the Big Bend ranch southern fence line. The water collects in a large concrete trough. The spring water is frequently used by residents in the Lajitas-Terlingua area, being a dependable source of good drinking water. On May 15, 1978, the flow was 0.06 lps.

Three kilometers south-southwest of Smith Springs are **Primero (First) Springs**, also called **Trough Springs** on some maps. On May 15, 1978, their discharge was 0.35 lps.

Four kilometers west of Lajitas on Walter Mischer's property are **Rock House Springs (64)**. Issuing from faulted Tertiary Chisos porphyry, the water formerly supplied the old rock house which stands across the highway. On May 19, 1978, the discharge was 0.12 lps, partly from a pipe. Minnows swim in the pool, shaded by willows and buttonbush. Tiger salamanders have also been found here.

About 15 kilometers west-northwest of Lajitas are some small springs in *Madera* (Wood) Canyon, which form Madera Falls. A little farther west, at the head of Panther Canyon, are **Panther Springs (72)**. A rare spurge plant grows here. Mexican beavers, which do not build dams or lodges, live downstream. Two old adobe buildings stand nearby. On May 17, 1978, the flow from these and other downstream springs was 0.35 lps near the mouth of the canyon.

In Rancherías Canyon 11 kilometers southwest of the Big Bend ranch headquarters are **Rancherías (Villages) Springs (19)**. They were named for the pueblos which were found here by Captain Joseph Idoyaga in 1747. In Castaneda's (1936) words,

From San Antonio de los Puliques, Captain Idoyaga went on to the south along the river for a distance of about eleven leagues. He was obliged to make many detours on account of the roughness of the country and the fact that the river flowed through a deep canyon. Here they found the ruins of the abandoned Pueblo of the Tapacones, where the walls of the old church were still standing. They were of adobe. The Pescados had lived here also and had raised corn and pumpkins in the narrow valley, but they had recently been forced to

abandon the site and to go to San Antonio de los Puliques because of the hostility of the Apaches. A league from the abandoned site were two small springs which were called San Andres.

On July 26, 1976, 0.20 lps of water from Rancherías Springs was passing over Highway 170 at the mouth of the canyon, and probably much more was moving through the coarse alluvium beneath. On May 17, 1978, 0.85 lps trickled from the Tertiary Fresno porphyry at the springs but, although several other springs emerge downstream, no flow reached the canyon mouth. The porphyry contains many calcite veins. Solution of the calcite has formed fissures through which the spring waters emerge.

The water from Rancherías Springs flows into a deep pool in the massive rock, in which water boatmen and small black snails live among the water milfoil. (See Plate 15, e). Yellow-breasted kingbirds frequent the cottonwoods and willows. Canyon tree frogs have also been found here. Burned-rock hearths and bedrock mortar holes indicate that the springs have been used by people since ancient times.

**Tapado (Closed or Hidden) Springs (70)** are three kilometers west of Rancherías Springs. These and other springs downstream in Tapado Canyon provide a haven for the broad-tailed hummingbird, the prairie falcon, a rare white-and-yellow-flowered goldenweed, and big cenchrus grass. **Oso (Bear) Springs (71)** are about three kilometers upstream in the canyon. On May 17, 1978, the discharge at the mouth of Tapado Canyon was 0.42 lps.

**Bofecillos Springs (69)** are in Bofecillos Canyon six kilometers northeast of Redford. Pictographs in rock shelters indicate that people lived here long ago. On May 17, 1978, the springs produced a flow of 0.25 lps at the mouth of the canyon.

Two interesting springs northwest of here were probably visited in 1747 by Pedro de Rabago y Teran. In the words of Castaneda,

The following day he crossed the Rio Grande into Texas and traveled to some high hills to the east, and after going about three leagues came to a small ravine in which he found a spring around which grew some cottonwoods. To the east of Presidio, about ten miles, is Alamito Creek, and a mile or two east of it is Black Hills Creek which is joined by another just as it enters the Rio Grande. This latter stream is Tomeros Creek, which runs almost due east and seems to be the one which Rabago y Teran followed, going ten leagues farther east that day. He was told by his guides that Alamito Creek was the trading ground where the mission Indians from La Junta met the Apaches to exchange their wares.



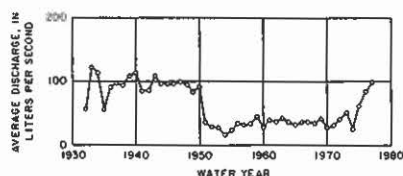
The next day he turned northeast and went five leagues before coming to another ravine with a spring. This ravine seemed to divide two ranges of mountains.

The first spring mentioned (13) is still in a cottonwood grove which can be seen from a great distance in this arid land. It is on Torneros Creek at latitude 29°33' and longitude 104°13'. On July 19, 1976, 7.5 lps issued from gravel and flowed for one kilometer before again sinking into the alluvium. At the time of the writer's visit a flock of vultures was stationed here, waiting for something to die. These springs do not appear to have a name, and perhaps should be called **Rabago y Teran Springs**.

The second spring described was in all probability **White Spring (53)**, 10 kilometers south-southwest of Casa Piedra. Located on Jack Rawls' ranch, it is now only a seep of algae-rich water from Tertiary Rawls conglomerate, flowing about 100 meters before sinking into the sand. Chalcedony and flint flakes indicate that this was a popular place thousands of years ago. An impenetrable thicket including desert willows surrounds the seeps. Doves and other birds make their home here.

Six kilometers northwest of Redford on Teofilo Carrasco's ranch is a group of bedrock mortar holes in welded tuff and breccia (66). Very likely there were springs here, which were used by the prehistoric people who ground the mortar holes. Now the site is dry and covered with creosote bush, ocotillo, and mesquite.

Just above the mouth of Alamito Creek and a stream-gaging station operated by the International Boundary and Water Commission are another **Alamito Springs (55)**. Situated eight kilometers southeast of Presidio, the fresh water rises through faults in a bed of conglomerate at an elevation of 780 meters on Edmundo Nieto's property. In the sixteenth century Spanish explorers found the Jumano village of San Antonio de Padua at these springs, the largest in the county.



*Discharge of Alamito Springs*

Daily discharge measurements made since 1932 show that Alamito Springs have never failed in that time. A minimum flow of 2.8 lps was reached on July 25, 1953 and on several days in August, 1958. The discharges shown on the accompanying graph represent average low flow contributed by the springs, and exclude storm runoff. It is evident that Alamito Springs flow has decreased. The main loss occurred during the drought of the 1950s, and has not been significantly recovered in subsequent years of above-average rainfall.

Near Presidio are the dry remnants of other springs, probably copious in former times, which supported the large population of Patarabueye Indians who lived here for thousands of years.

Twelve kilometers northwest of Presidio are **Chupadera (Seep) Springs (54)**, on Manuel Soza's ranch. In 1974 they trickled 0.35 lps. On May 18, 1978 there was only a seep from Quaternary gravel. Horses were forced to kneel in order to lick a little water from puddles at the bottom of a sump. On June 21, 1979, the discharge had recovered to 0.06 lps which filled a water trough and ran about 40 meters. Cattails, pink moss rose, and white milkwort grow among the rocks. Midges, butterflies, and squirrels frequent the springs. The water trickles from Quaternary gravel on conglomerate.

**Peguis Warm Springs (36°C)** are 34 kilometers west-southwest of Presidio in Mexico.

Nine kilometers east of Shafter, at Hart Greenwood's headquarters, are another **Cienaga Springs (9)**. They are very marshy and overgrown with tules. On July 20, 1976, they flowed 9.5 lps from gravel, compared with 57 lps in 1926. Milton Faver, known mostly for his peach brandy, built a fort here in 1870 which is still used as a part of the Greenwood home. Very large cottonwoods surround the site. The water is used for irrigation, including an enormous fig tree. Cienaga Creek above this point flowed 8.0 lps on the above date, from numerous other springs upstream.

Seven kilometers southeast of Shafter and also on the Greenwood ranch are **Moritas (Little Mulberries) Springs (10)**. On July 20, 1976, they produced 4.5 lps from a jointed rhyolite. The flow continues downstream for two kilometers before disappearing. Here in 1870 the La Morita sheep ranch was raided by Indians and some of the residents killed. At the abandoned ranch headquarters are two very old ponds used to collect the water for irrigation, with large ash and other trees growing out of the dams. Western kingbirds and other wildlife depend upon the springs. The mul-

berries appear to be gone. Here an interesting device called a hydraulic ram is still used to pump water from one of the springs up into a reservoir. The ram requires no power aside from that provided by the head of water, but it does waste a large amount of water used for power compared with the amount pumped.

In the vicinity of the old silver-mining town of Shafter are several good springs. One group is **Big or Cibolo (Bison) Springs (11)** seven kilometers northwest of Shafter, on the south bank of Cibolo Creek. Castaneda described Captain Joseph Idoyaga's visit to the site in 1747:

The site of the old Pueblo of the Cibolos was in a deep creek that ran north and south and whose banks were steep and heavily wooded. Not far from the creek the walls of the old pueblo and the ruins of its mission and the irrigation ditch, made to take water from the creek, were visible. The ground that was once cultivated was capable of taking two and one-half fanegas of grain (two hundred and fifty pounds of seed) ... Some of the Cibolos who accompanied Idoyaga explained that their people were forced to abandon their mission because of Apache hostilities.

Milton Faver had a fort here also. His peach brandy was produced from a peach orchard irrigated by the springs. They are now on Russell White's ranch. They flowed 14 lps on July 24, 1976, from Perdiz conglomerate on igneous extrusive rocks.

Cibolo Springs are covered with water cress and surrounded by a grove of trees, algerita shrubs, and grapevines. Red and yellow tanagers and yellow-headed blackbirds make their homes here. The water is now conveyed in a ditch to a reservoir, and used for stock, domestic, and irrigation purposes.

Above this point Cibolo Creek flow is maintained during the winter by many other springs, including **Cienagita (Little Swamp) Springs**.

Seventeen kilometers west of Shafter on El Rancho Chaa are still another **La Cienaga Springs (12)**, at latitude 29°46' and longitude 104°29'. The warm (30°C) but fresh water flows from igneous rocks onto the top of a mudstone which laps up against the igneous outlier. The discharge was 2.0 lps in 1974 and 0.55 in 1976. It forms about one hectare of grassy swales which contrast sharply with the very dry surroundings. The flow enters Spencer Creek and disappears in its bed about 300 meters downstream.

**Spencer Springs (30)**, six kilometers east-north-east, trickled 0.63 lps of fresh water in 1976. Here John Spencer set up housekeeping in 1851.

**Ojo Bonito or Pretty Spring (51)** is 19 kilometers north-northwest of Shafter in the foothills of the Chinati

Mountains at latitude 29°59' and longitude 104°23'. It is on L. R. French's Dipper ranch, operated by Andy Prude. In 1870 Faver had a ranch camp here. The water issues from Tertiary volcanic and Pennsylvanian limestone rocks amid boulder-covered hills. On June 20, 1979, the flow of 0.06 lps ran 20 meters before sinking into the sand. The site is shaded by seepwillow, live oak, huisache, cedar, hackberry, and chinaberry trees and algerita shrubs. Jackrabbits, hummingbirds, and hawks are numerous. Several wells sap the groundwater nearby.

## RAINS COUNTY

Most of Rains County's springs issue from Eocene Wilcox sand and sandstone. Unless otherwise noted, this is the usual spring aquifer. A few very small springs trickle from Paleocene Wills Point and Kincaid sand and silt in the western part of the county. These formations dip toward the southeast at 8 to 12 meters per kilometer.

Archeological sites have been found near springs over most of the county. For thousands of years prehistoric people lived here. At the dawn of history in the area, the Caddo Indians had villages by the springs. These people raised crops of corn, beans, squash, sunflower seeds, and tobacco.

The usual vegetation in the springs environment includes marsh purslane, cattails, cottonwood, willow, sweetgum, and sycamore trees, wild plum bushes, and grapevines. In the fall various trees on the surrounding hills produce beautiful red and yellow colors. These include black gum, sassafras, sumac, American Beautyberry, dogwood, and red oak.

The water table has fallen to some extent, chiefly because of well pumping. Flowing wells also needlessly drain much water from the aquifers. As a result, the springs are not as strong as they once were.

The spring waters are generally of a sodium bicarbonate type, fresh, moderately hard, and of neutral hydrogen ion concentration (pH). The iron content is often high. Contamination by nitrates and coliform organisms has been caused by sewage and stockyard effluents in some cases.

Most of the writer's field studies were made during the period September 22-27, 1979. As most of the county received around 13 centimeters of rainfall in the two preceding weeks, the observed spring discharges are probably higher than normal for this season.

According to Valeria Groves, chairman of the county historical committee, Emory was once called Springville because of the many springs in the vicinity.



Dam at Springville Springs.

The largest group of the **Springville Springs (2)** form a branch which flows through the city park on the north side of town. Above a small dam in the park, minnows swim among the marsh purslane and duckweed. On September 24, 1979, 5.8 liters per second flowed over the dam. One spring of the group originates in the park, where it is walled up. It produced 0.18 lps on this date, trickling near picnic tables and grills.

About 800 meters south, where the spring branch crosses Highway 19, the discharge increased to 14 lps on this date. Here the water was formerly used by the B and B washateria.

In 1872 Reverend Ambrose Fitzgerald and his family settled on a spring branch (3) about four kilometers northeast of Emory. **Fitzgerald Springs** are now Norwin Lennon's property. On September 24, 1979, a flow of 6.1 lps was entering Hauak Lake just downstream.

Ten kilometers north-northeast of Emory on Bill Potts' ranch are some very small, slightly saline springs (4). Mr. and Mrs. John R. White, nearby neighbors, formerly hauled their water from them. On September 23, 1979, **Potts Springs** discharged 0.06 lps. The water contains an orange precipitate and is evidently high in iron content. Several dead trees, blackberry bushes, purple ironweed flowers, and bluntscale bulrushes surround the springs. A short distance downstream (south) where West Elm Creek crosses Highway 514, the discharge had increased on this date to 0.55 lps from these and other nearby springs.

**Penson Springs (5)** are eight kilometers east of Emory on John Lumpkins' ranch. The several springs feed Penson Springs Branch. On September 25, 1979, the discharge was 2.9 lps. Frogs and minnows live among the white-flowered arrowhead plants, marsh purslane, and cattails.

**Willow Springs (6)** are seven kilometers south of

Emory on Hazel Parrish's ranch. The water feeds Greene's Lake on Floyd Greene's ranch. Greene has found many flint projectile points in the vicinity. The Willow Springs church and cemetery are just west of the springs. On August 12, 1942, the flow was 0.06 lps. On September 24, 1979, it was 0.85 lps after much rain. Turtles and frogs swim among the marsh purslane, shaded by sweetgum trees. Blue herons and cattle egrets thrive here. Many other springs trickle nearby.

Eleven kilometers southwest of Emory and three southeast of the Flats community are several Indian campsites on Woodbury Creek. Springs (7) pour from the base of the Wilcox sand along the creek here. On September 24, 1979, the discharge was 6.8 lps. Just upstream the creek divides into its two main tributaries, Shuffle and Reeder Creeks. As most of their drainage area lies in Wills Point silt, they do not collect much spring flow. On September 24, 1979, Shuffle Creek was flowing 0.92 lps and Reeder Creek 0.55 lps, both at the Highway 2324 crossing. Most of the springs are below the junction of these two creeks at Woodbury Creek.

Ten kilometers southwest of Point was an Indian village, now beneath the waters of Lake Tawakoni. There were springs (8) here, near the mouth of Bull Creek, probably trickling from Kincaid sand and limestone. In 1760 Fray Joseph de Calahorra y Saenz was sent to restore peace between the Spanish and the tribes along the north central Texas-Oklahoma border after the disastrous Spanish defeat by the Taovayas at Spanish Fort. He visited a Tehuacana and Yscani village, probably at this site. He reported that the village contained 47 large houses, streets, and gardens containing maize, beans, and pumpkins.

## RANDALL COUNTY

Most of Randall County's springs issue from Ogallala sand and gravel, which dip gently toward the east and toward the major streams. Some flow from Triassic Dockum (Santa Rosa) sandstone which underlies the Ogallala. Usually the springs emerge from these formations where they rest upon the less permeable Permian shale, siltstone, sandstone, and dolomite.

The springs have been favored living sites since at least 12,000 years ago, when Paleo-Indians hunted numerous now-extinct animals in the area, including mammoths, sloths, saber-toothed tigers, camels, hyenas, and three-toed horses. Early Indians inhabited caves and rock shelters in Palo Duro Canyon near the springs. (*Palo duro* is Spanish for *hard wood*, in reference to the cedars which were used by the Indians for



bows and arrows.) In historic times several Plains Indian tribes, including the Apaches, Cheyennes, Arapahoes, Kiowas, and Comanches, camped at the springs.

At the dawn of New World history these springs were the haunt of bears, buffalo, deer, antelope, wolves, panthers, elk, mustangs, foxes, prairie chickens, turkeys, ducks, and many other animals. Many of them have now disappeared, as have numerous plants which were associated with the springs. The usual plants still found in the spring environment include cottonwoods, willows, some salt cedars, grapevines, plum thickets, cattails, and rushes.

In 1906, although some damage had already been done to the groundwater table, the canyons were fed by numerous "ever-living springs." Waterfalls 15 to 30 meters high, draped with maidenhair ferns on the adjacent cliffs, were very popular spots for outings. Gould stated in 1907 that at the junction of Palo Duro and Tierra Blanca Creeks each flowed a constant, spring-fed 15 cubic feet per second (425 liters per second). (*Tierra blanca* is Spanish for *white earth*). Otho Whitefield of Friona remembers when Palo Duro Creek always ran chest deep with spring water, and the playa lakes were filled with clear water. In 1909 4.5 kilo (10 pound) bass were caught in Tierra Blanca Creek.

All this has greatly changed now. The water table in the Ogallala formation has fallen drastically in recent years. Pumping of groundwater for irrigation has been the primary cause, but other activities of man caused a drop in the water table as early as the 1880s. As a result, many springs have weakened or dried up. In addition, many ranchers are finding it necessary to deepen their windmill wells, or to haul water to their stock.

The spring water is generally of a calcium bicarbonate type, fresh, very hard, and alkaline. The content of silica and fluoride may be high.

Most of the writer's field studies were made during the period August 8-13, 1978. Heavy rains and the record flood of May 26, 1978, contributed much recharge to the Ogallala formation. Consequently the observed spring discharges are believed to be somewhat higher than normal for the summer months.

**Dean Springs (17)** were 20 kilometers south-southeast of Wildorado on Mrs. H. D. Fowler's ranch. At the junction of Palo Duro and North Palo Duro Creeks, this was a favorite haunt of Indians. In the 1890s the Dean post office was located in a cave in the caliche nearby. At that time there were holes in the creek here that would "swim a horse." Perch, bass, and catfish could easily be caught with a wire basket. Swimming was popular here until the 1930s, according to Jim Gwyn, who ranches nearby. The holes are now

filled with sand, and the springs and creeks stopped flowing around 1950. The water table is now about 10 meters below the surface. Much irrigation and Canyon municipal pumping of groundwater is done nearby. A grove of trees still stands at the former springs.

**Long Springs (14)** were six kilometers northwest of Canyon on Palo Duro Creek where the Canyon country club now stands. Here George Long and his family built a cabin in 1894. Large bass could be caught in the creek at that time. According to Dude Kinkade, manager of the golf course, there was a swimming hole in the creek here until the 1940s, and the creek dried up in the late 1950s. Wells used to irrigate the golf course have probably hastened the water-table decline. Hackberry trees and a few cottonwoods still line the dry channel in a shallow canyon fringed with caliche cap rock.

Three kilometers north of Canyon the T-Anchor ranch headquarters was established in 1879 at the junction of Spring Creek and Palo Duro Creek. At that time **T-Anchor Springs (11)** on Spring Creek flowed copiously, and alfalfa was later subirrigated by the shallow groundwater. A few seeps still exist on Spring Creek, now on A. W. Lair's property. A gravel-pit well upstream has hastened the springs' demise.

Of the adjacent Palo Duro Creek, Francisco Aman-gual, a Spanish explorer, wrote in 1808, "a creek named El Blanco, where there are some springs of water" (Loomis and Nasatir, 1967). He found a group of Indians at these springs. The springs (12) once provided water for irrigation, said to have been the first irrigation in the Panhandle. Fishing and picnicking were popular here. According to Robert Lee, manager of the West Texas State University Horse Center, there are still some seeps into two reservoirs on the creek, but no longer any running water.

Nine kilometers northeast of Canyon, at the Six-mile crossing of Palo Duro Creek, T. C. Jennings and his family settled in 1908. Springs along the creek (10) provided ideal facilities for swimming and picnicking. Some seeps and pools of live water still exist at Boy Scout Camp Don Harrington, which occupies the site now. But sewage from Canyon overshadows any remaining spring flow.

Farther downstream, 16 kilometers northeast of Canyon, some very small springs and seeps (4) still trickle on John Currie's property. They are located just downstream from Lake Tanglewood, which probably contributes to their recharge. An Indian village was once located here.

Twenty-one kilometers east-northeast of Canyon are **Blue Springs (3)** on Dean Williams' ranch. Near

these very small springs are some Indian petroglyphs in the Dockum sandstone.

Four kilometers farther downstream were some former springs (2) on Dr. Guy Owens' property. Bed-rock mortar holes in the sandstone disclose that this was a favorite campsite long ago.

**Tub Springs (1)** were northeast of Palo Duro State Park on Charles Beedy's Tub Springs ranch. They were at latitude 34°57' and longitude 101°38'. Worked flakes and cores of Alibates flint can be found here, signifying that this was once a preferred campsite. Immediately after a 4-centimeter rain on August 10, 1978, the springs were dry. They are said still to seep in winter. The water once flowed in a two-meter by two-meter concrete box, still there. Mule deer and aoudad sheep cavort among the cedars and cottonwoods.

In Palo Duro State Park several very small springs still trickle weakly. **CCC Springs (7)**, boxed in by a CCC camp, produced 0.38 liter per second on May 11, 1937, from Triassic sandstone. On August 11, 1978, the flow was 0.05 lps from an elevation of 975 meters, piped to the Cottonwood picnic area.

On Little Sunday Creek north of the "Lighthouse" there was once a spring (8), which still seeps. There must have been a good supply of water here several thousand years ago, as an Archaic archeological site was found here. Rollin Harden, Austin groundwater consultant, analyzed the water from **Little Sunday Spring** (then a standing pool) in 1961 (see Table of Selected Chemical Analyses). Timber Creek also still contains some very small springs (9).

According to Elan Baker, Palo Duro State Park superintendent, Prairie Dog Town Fork of the Red River flowed constantly in 1969 when he came here, and for several years thereafter. Now it dries up in the summer except for a few small pools.

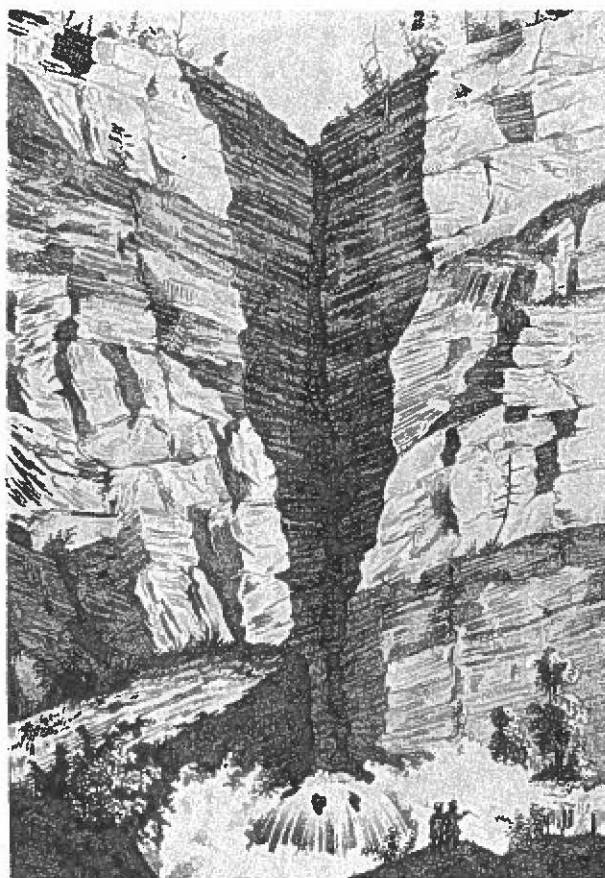
**North Cita Springs (6)** were in North Cita Canyon in the southern part of Palo Duro State Park. (*Cita* is the Spanish word for *engagement*, in reference to the encounter between the Comanches and Gen. Mackenzie's forces which occurred near the mouth of the canyon in 1874.) Access to the former springs site is best gained through Shirley Harrell's ranch, leased by Carl Davis. The springs are now dry. Some believe that this was the place which Capt. Randolph Marcy mistook for the source of the Red River in 1852. More likely it was in South Cita Canyon.

**South Cita Springs (5)**, the largest in the county, are in South Cita Canyon 15 kilometers west-northwest of Wayside. They pour out in the Methodist Camp Ground, managed by J. V. Patterson. They discharged 7.5 lps on August 10, 1978, from an elevation of 1,020

meters, running five kilometers with the aid of other springs downstream. Large yellow fluttermill flowers and cedar trees adorn the creek, in addition to aquatic plants. Water snakes and minnows make their home among the three waterfalls downstream.

About four kilometers downstream from the Methodist Camp Ground, on Woodrow Wesley's ranch, is probably the site which Marcy mistook for the head of the Red River, or Keche-ah-que-ho-no. His account of the adventure follows:

July 1, [1852] — We saddled up at a very early hour this morning, and proceeded on up the river for several miles, when we found a large affluent putting in from the north; and after travelling a few miles further, we passed many more small tributaries, which caused the main stream to contract into the narrow channel of only twenty feet; and its bed, which from its confluence with the Mississippi to this place (with the exception of a ridge of rocks which crosses it near Jonesborough, in Texas) had been sand, suddenly changed to rock, with the water, which before had been turbid, flowing clear and rapidly over it; and, much to our delight, it was entirely free from salts. This was certainly an unlooked-for luxury, as we had everywhere before this found it exceedingly unpalatable. As I before observed, the effect of this water upon us had been to produce sickness at the stomach, attended with loss of



South Cita Springs, mistaken by Marcy for the head of the Red River.

appetite, and a most raging and feverish thirst, which constantly impelled us to drink it, although it had a contrary effect upon us from what we desired, increasing rather than allaying thirst.

After undergoing the most intense sufferings from drinking this nauseating fluid, we indulged freely in the pure and delicious element as we ascended along the narrow dell through which the stream found its way. And following up for two miles the tortuous course of the gorge, we reached a point where it became so much obstructed with huge piles of rock, that we were obliged to leave our animals and clamber up the remainder of the distance on foot.

The gigantic escarpments of sandstone, rising to the giddy height of eight hundred feet upon each side, gradually closed in until they were only a few yards apart, and finally united over head, leaving a long, narrow corridor beneath, at the base of which the head spring of the principal or main branch of Red River takes its rise. This spring bursts out from its cavernous reservoir, and, leaping down over the huge masses of rock below, here commences its long journey to unite with other tributaries in making the Mississippi the noblest river in the universe. Directly at the spring we found three small cotton-wood trees, one of which was blazed, and the fact of our having visited the place, with the date, marked upon it.

Marcy's description roughly corresponds to the actual conditions in South Cita Canyon. The large boulders and high cliffs of Triassic sandstone which he describes may be seen here. As he was trying to reach the source of the Red River, he would naturally ascend the tributary containing the most water. Today South Cita Canyon contains much more water than either North Cita Canyon or Prairie Dog Town Fork at this point. Very likely this was the case in 1852 also, although at that time all of these streams ran much more copiously. For these reasons the writer believes that Marcy mistook South Cita Canyon for the head of the Red River.

Three kilometers south of Canyon on the south side of Tierra Blanca Creek Nicholas Thompson and his family built a dugout in 1889. **Thompson Springs (13)**, 150 meters away, provided their water, and were used for washing by most of the residents of Canyon. The site of the springs, now dry, is on Cecil Simms' property. A well which was later dug near the springs is filled with sediment. An old road once passed the springs, according to Simms. Tierra Blanca Creek also is now dry here.

Eleven kilometers west-southwest of Canyon on Tierra Blanca Creek were **Carruth Springs (15)**. They were reported to be flowing in 1937. Now there is only a hole of live water in winter, dry in summer, on Raymond Hinders' ranch. Many frogs and snakes prowl among the button bushes and other water-loving plants.

Several springs formerly emerged in and near Buf-

falo Lake. One (16) was on Spring Draw northwest of the lake. Another, near the dam, was called **Ojo Frio** (Cold Spring). They were shown on G. L. Gillespie's 1875 *Map of portions of Texas, New Mexico, and Indian Territory*, but are now only seeps. There were originally several natural spring-fed lakes here. When Buffalo Lake dam was constructed in 1938, many springs upstream on Tierra Blanca Creek as well as in and near the lake continued to feed water to it.

But when the springs began drying up, the lake suffered. According to Larry Wynn, assistant manager of the Buffalo Lake National Wildlife Refuge, the lake was completely dry for almost five years from 1973 to 1978. On May 26, 1978, it was filled again by a record flood. It soon began to dry up again, as springs no longer feed it and the water table is falling. In the early days of the refuge 275 species of birds lived or stopped here.

## RED RIVER COUNTY

The Kadohadacho tribe of the Caddo confederacy and their predecessors lived in present Red River County for many thousands of years. The mounds built by these people were formerly common sights along the Red River, but have now largely been destroyed. They built their villages at the better springs of that time. In the 1820s many tribes of Indians, including the Kickapoos, Shawnees, Delawares, and Biloxis, driven out of their eastern homelands by the Anglo-American settlers, moved in and shared the area with the Caddoes. In the 1830s they were expelled from this land also. The Burkham settlement near Pecan Point was probably the first Anglo-American settlement in the county, around 1815.

When the county was first settled there is no doubt that springs were much more numerous and larger than at present. Many flowing wells were drilled into the Blossom and Woodbine sands, two of the best aquifers in the county. These were allowed to flow freely, wasting great quantities of water and lowering the water tables. Along with pumping wells at a later date, this caused great declines in water tables, and many springs consequently ceased flowing.

Most of the writer's field studies were made during the period March 5-10, 1976.

The springs issue chiefly from Woodbine, Bonham, and Navarro sands and from river terrace sands and gravels. The water is generally of a sodium bicarbonate type, and is fresh, soft to moderately hard, and of neutral pH. Iron and sulfate may be present in objectionable quantities.



**Stout Spring (1)** was described by P. B. Clark in 1937, in his narration of James Clark's entrance into what is now Clarksville:

He found one of the original white settlers of Red River County, a man by the name of Henry Stout, camped at a spring, which was located about two or three hundred feet from what is now the public square of Clarksville and between East Broadway and East Main Streets, the spot now being covered by the B. & D. Chevrolet Company building...

In the early part of 1835 James Clark and his family moved from Jonesboro out to the skirt of timber which is now the very heart and center of the City of Clarksville. They camped at the spring (referred to above), where they found Henry Stout, and were making preparations to build their home.

Stout had been in the vicinity since 1818. In 1820 about 700 Delawares, displaced from the east, came to live on nearby Delaware Creek and remained until they were forced out in the 1830s. The spring flowed from Annona chalk. Being beneath a building now, it can no longer be seen. In all probability, however, it is dry, as there has been a great deal of well pumping in the vicinity.

One kilometer west of Kanawha are **Rock Springs (10)**. As early as the 1820s these springs were very popular with the residents of the area, who came to wash clothes and fill containers with the water. Flowing 0.45 lps in 1976 from Quaternary and Woodbine sands, the springs have now been covered by a lake on the Allison ranch. Their discharge was estimated from the lake outflow, allowing for evaporation.

About 10 kilometers north of Manchester, on Highway 410, is a group of historical markers. **Jones Springs (9)** are about 300 meters northeast of the markers. In 1774 the Frenchman Gagnard, travelling up the Red River by boat, may have stopped here for water. The Jones ferry began operating here before 1820. Gradually the town of Jonesboro, later Davenport, grew up. This was near the head of navigation on the Red River. When Sam Houston first entered Texas here in 1832, he quite possibly quenched his thirst at these springs. The springs, flowing 0.20 lps in 1976 from terrace sands into a timbered swamp at the base of the bluff, are covered with water cress and tiny duckweed plants.

**Tuggle Springs (8)**, seven kilometers northwest of Negley, were the basis of a pre-Civil War community of the same name. Flowing 0.21 lps in 1976 from Bonham sand, they are in a wood 100 meters east of the Tuggle Springs cemetery.

Thirteen kilometers north of Negley at the Red River was the community of Mound City or Old Roland, now

called Allison. **Roland Springs (7)**, which formerly flowed from terrace sands just east of the Highway 37 bridge, were much used by the early residents and by ferry travelers. Later they were used by the school at this location. They are now dry.

About 17 kilometers east of Negley, on the Harvey ranch at latitude 33°45' and longitude 94°53', are **Bryarly Springs (6)**, the largest remaining in the county. In early times a Frenchman named Atchafalaya and his Indian wife had a log cabin near here and probably used the springs. Later there was a plantation, ferry, and steamer landing here. The springs flow from river terrace sand and gravel. The discharge of 6.2 lps on March 9, 1976, was partially surface runoff from preceding rains.

**Pecan Springs (5)** were on the road at Pecan Point (Chapman ranch) 17 kilometers north of Avery. Caddo Indian mounds indicate ancient use of these springs. Here, at latitude 33°42' and longitude 94°48', Claiborne Wright camped in 1815. The springs flowed strongly from river-terrace sands into a square walled enclosure until 1975, when a well was installed. There has been no flow since. This was formerly a great cotton center, but it has now reverted to ranching and hunting uses.

**Coleman Springs (4)**, eight kilometers south of Annona, were the site of the pre-Civil War community of that name, according to Mrs. Helen Hale, a local historical authority. Nothing is left of the old community now except a few foundations and jonquil beds in some woods. Flowing from Navarro sand on top of sandstone, some of the springs have now been inundated by Crystal Lake. Some are reported to be high in sulfate or iron content. The springs are the chief source of water for the recreational lake. At the time they were visited there was a large flow over the lake spillway due to recent rains. The normal spring flow is reported to be



Outflow from spring-fed Crystal Lake.

about 3.0 liters per second.

Before 1820 a friendly old Delaware chief who had three fingers cut off by a saber was found by early settlers to be living at what is now the Cuthand community, probably at the springs (3) of that name. Flowing 0.15 lps in 1976 from Navarro sand, they are just west of the Cuthand cemetery, 17 kilometers south of Clarksville, at latitude 33°28' and longitude 95°03'.

The community of **Maple Springs (2)** grew up and around the springs of that name. They are now in northeast Bogata. The main spring is in a small pond on Otis Tucker's place, just east of the city park. Another supplies Maggie Hunsaker's minnow tanks one block north. Flowing from the Navarro sand, they are no longer as strong as they once were, but delivered 0.25 liter per second in 1976.

## REEVES COUNTY

The great springs of Reeves County were of course occupied by early Americans thousands of years ago. Lt. Antonio de Espejo in 1583 and other early explorers were introduced to some of these springs by the Indians. Kirkland and Newcomb (1967) described pictographs in rock shelters near Balmorhea. According to the well-known Balmorhea writer Frankie Kingston, evidences of very old irrigation ditches and burned-rock middens, probably left by the Jumano Indians, have been found near San Solomon and Giffin Springs.

In 1849 Major Robert Neighbors, the federal Indian agent in Texas, found the Mescaleros growing corn along Toyah Creek. He also found an ancient Spanish fort near San Solomon Springs with peach trees growing nearby. The old Spanish settlement of Brogado, just east of Balmorhea, was probably occupied in the late 1700s.

Most of the springs in the county flow from Comanchean limestones, which correlate with the Edwards and associated limestones found in the Balcones fault zone between Del Rio and Waco. Some issue from bolson or valley-fill gravels and sands.

Because of heavy well pumping for irrigation, water levels have been drawn down as much as 150 meters. As a result, many springs have dried up. In the last few years (before 1976), according to Pecos businessman Jesse Bush, 300 wells have been abandoned because of the high cost of fuel and the increasing lift required to bring the groundwater to the surface. This will slow the water-table decline, but it would be idle to hope that water levels will rise appreciably or that any of the lost springs will begin to flow again. By far the majority of

the county's springs are only memories, and there is a danger that even the largest springs will eventually fail. The major creeks, such as Cottonwood Creek, Salt Draw, and Ninemile Draw, are all dry now except during storms.

Most of the springs formerly gave rise to bogs or *cienagas* within which grew cattails, sedges, rushes or *tules*, sacaton grasses, common reed, and saltgrass. Cottonwood and willow trees often surround the bogs. Today most of this vegetation has disappeared with the springs, along with much animal life which depended upon them. Dark gray organic soils point to the location of these former *cienagas* and their teeming wildlife.

The spring waters which remain are largely of a calcium bicarbonate type, slightly saline, very hard, and alkaline. The water is usually high in sulfate and chloride, but since the sodium content is fairly low, it can be used for irrigation. It is too saline for use as drinking water, and for this reason Balmorhea and Toyah use fresh spring water from the Davis Mountains in Jeff Davis County.

Most of the writer's field studies were made during the period June 9-16, 1976.

When the railroad reached Toyah in 1882 there were several springs flowing from alluvial sand there, according to old residents. After flowing wells were drilled in town, **Toyah Springs (4)** declined and dried up in the 1940s. Thirteen kilometers southeast of Toyah on Ninemile Draw were **Ninemile Springs**. They flowed until 1973 when they failed, probably because of heavy industrial pumping in the vicinity.

**Petican Spring (3)** is 16 kilometers west of Toyah at latitude 31°20' and longitude 103°57'. Some old maps called it **Petrikin** or **Pelican Spring**. It emerges beneath a large cottonwood tree, flowing from Comanchean limestone and conglomerate with travertine deposits, and supplies a stock tank. It was used for irrigation of crops at one time. Coyotes are common here. The discharge was 2.2 lps in 1940 and 1947 and 1.6 in 1959 and 1976. As it is in an area of declining water table, this spring has a limited life ahead of it.

Many other springs in this area have gone dry. There was formerly a large group of springs in the general vicinity of Petican Spring which flowed from the same limestones. **Liege** or **Bone Spring (2)**, four kilometers southwest of Petican, flowed into a water trough in a salt cedar and mesquite grove. In 1940 and 1947 it trickled 0.63 lps, in 1959 it flowed 0.19, and in 1976 it was dry. **Torez** or **Coyote Spring (24)** was two kilometers northwest of Petican Spring. It flowed 0.13 lps in 1940 and 1947, but failed before 1959.

A few kilometers farther north, along China Draw, was another group of springs. These were all moderately saline, and the precipitates built up travertine mounds around each spring. **Canyon Spring (26)** was at latitude 31°24' and longitude 103°56'. It flowed 0.51 lps in 1940, 0.38 in 1947, and dried up before 1959. **Burnt Spring (15)**, six kilometers west of Canyon Spring, produced some crude oil along with the water. It flowed 1.8 lps in 1940, 1.6 in 1947, and was dry in 1959. **Turin Springs (27)** (called **Twin Springs** on some maps), three kilometers east of Canyon Spring, produced 0.51 lps in 1940, 0.63 in 1947, were "almost dry" in 1959, and are very dry now. **Johnson Spring (28)**, which formerly fed a lake just north of Turin Springs, produced 0.51 lps in 1940, 0.38 in 1947, and failed before 1959.

In Red Bluff Reservoir and up the Pecos River to Amerada Falls, 1.6 kilometers north of the New Mexico state line, are many small, moderately saline springs (35). They issue from Permian Rustler limestone and dolomites which dip in various directions in a collapse zone. Here killifish, brine shrimp, and turtles live among the salt cedars and rushes. On May 8, 1978, the discharge of those above the reservoir surface was 0.68 lps. The water is moderately saline.

On May 7, 1978, after much dry weather, Screwbean Creek was carrying 32 lps just above its junction with the Pecos River below Red Bluff Reservoir. Most of this water is derived from springs on Screwbean and Salt Creeks in Culberson County.

In 1761 Captain Felipe Rabago y Teran, Spanish commander of the San Saba presidio near Menard, found a large Faraon encampment at some springs near Pecos. The five springs, called **Alamo** or **Mitchell Springs (1)**, flowed from alluvial sand and caliche four kilometers northwest of Pecos. Mark Mitchell and his family are reported to have built a cabin in the 1880s at these "strong springs." Here they raised the first vegetables in the area. The springs abounded with fish and were surrounded by grapevines, fruit trees, and cottonwoods. Many baptisms and picnics were held there. Albert Holdman, who owns the property now, remembers when they were very popular for swimming. The springs dried up around 1948. All of the cottonwoods have died except one, which is struggling to stay alive.

**Irving Springs (6)** were located at West Toyah Lake on the Bush Estates, 10 kilometers south of

Pecos. Castaneda (1936) described De Espejo's visit to these springs in 1583:

Setting out on August 8, from the vicinity of present Pecos (Texas), they marched five leagues to the southwest, "three of them up a stream." They found many Jumanos who were on their way to the Pecos in search of mesquite beans. They halted in a *rancheria* on this stream. This must have been Toya Creek, which they struck apparently below Toya Lake. "The Indians, men and women, received us with music," says the chronicler. "As a sign of peace and happiness there was held a dance between the tents of the Indian men and women."

In 1808 Francisco Amangual, another Spanish explorer, described Irving Springs in more detail (Loomis and Nasatir, 1967):

we reached *La Cienega* [the Marsh] on the shores of which are beautiful water holes; the water holes found to the west are heavily charged with sulphur and coppers; the others are less and less until one reaches the last on the east, which has clear fresh water.

The California Trail and Butterfield Overland mail route passed Irving Springs in the 1850s. Taylor (1902), calling them **Hackberry Springs**, described them as several springs, the largest seven meters in diameter, with a strong sulfur taste, but excellent for livestock.

The springs issued from sand, silt, and peat, and possibly from Cretaceous limestones beneath. As the figures in the table of Selected Chemical Analyses show, the water was high in sulfate. The discharge was 62 lps in 1904, 28 in 1924, and 2.8 in 1949, after which no flow has been recorded. Now there are only depressions in the peat bog with many small sinkholes and cracks. A mesquite grove surrounds the area. In 1968 the dry peat bog was struck by lightning and burned for several months.

**Buck Springs (29)**, eight kilometers east on the other side of Toyah Lakes, were similar. In 1940 they still flowed 0.31 lps, but they are quite dry now, and marked only by a little thicker growth of mesquite than elsewhere. Toyah Lakes are also dry except during floods.

Twenty-eight kilometers south of Pecos and four east of Hoban station were **Hoban Springs (7)**. They emerged from alluvial sand and gravel in Toyah Creek. In 1583 De Espejo found a Jumano *rancheria* here, and his party caught some very large fish in the springs. As recently as 1937 this was still a very popular fishing hole. In 1933 the springs discharged 42 lps, according to White, Gale, and Nye (1941). Now they are quite dry.

Fourteen kilometers northeast of Saragosa and four



east-southeast of Verhalen were **Santa Isabel** or **Sulphur Springs (8)**. In 1940 they flowed 1.9 lps from alluvial sand and silt, chiefly as sand boils in Toyah Creek. This was a favorite Mescalero camping ground. Many projectile points, metates, and manos have been found here. Later a cattle camp was located at the springs. They failed soon after 1940. A mesquite grove marks the site.

Three kilometers south of Interstate 10 and close to the Pecos County line, on the Graef brothers ranch, were **Keechi Springs (10)**. Extending up Barrilla Draw into Pecos County also, they were named for the Wichita Kichais who once lived here. Pictographs have been found in the hills nearby, as well as bedrock mortars, manos, and projectile points. The springs and Barrilla Creek are said to have flowed until around 1900, but have long been dry. G. F. Cram portrayed them on his 1885 map of Texas.

In the southern corner of the county on the U Bar ranch were **Ash** or **Lindsey Springs (20)**, at latitude 30°51' and longitude 103°33'. They and the similar **Twin Springs (21)** seven kilometers west were shown on two 1881 maps: F. de I. Carrington's *Map accompanying report of scout* and Livermore's and Butterfield's *Military map of the Rio Grande frontier*. Situated in volcanic rocks, both have been dry for many years. Ranch manager Timm Goode has found many metates, projectile points, and burned-rock middens near these springs. Ash springs, formerly walled up, were surrounded by black organic soils, disclosing that there was once a bog here.

**Weinacht Spring (22)** was located at the Weinacht ranch headquarters six kilometers south of Toyahvale. Flowing from volcanic rocks, it was formerly used for domestic and stock purposes. It dried up around 1960, flowed a little in 1973, but has now failed completely.

**San Solomon Springs (15)**, the largest in the county, are located in Balmorhea State Park at Toyahvale. They have also been known as **Mescalero** or **Head Springs** at various times. The artesian springs issue at an elevation of 1020 meters from caverns in the bottom of a large swimming pool. (See Plate 2, b). The water enters cavernous lower Cretaceous limestones in the Davis Mountains to the southwest. At the springs impervious upper Cretaceous rocks have been faulted down against the lower Cretaceous limestones containing the underground reservoir, causing the water to rise to the surface. Rainfall in the recharge area results in a large increase in discharge and suspended solids, and a large decrease in dissolved solids and water temperature. After strong rains the spring water tends to be-

come cloudy. The normal low-flow temperature of the water is slightly warm, 26° Celsius, indicating that it circulates through depths up to 300 meters below the surface.

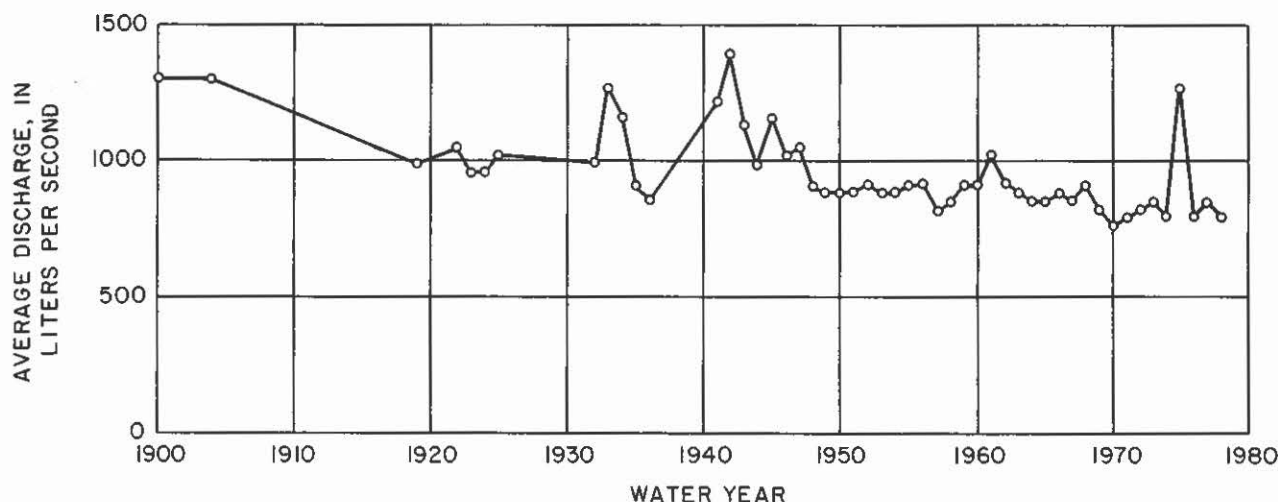
Hutson (1898) was able to trace the lines of prehistoric irrigation canals at San Solomon Springs, where the Jumanos, and later the Mescaleros, directed water to their corn and peaches. Many projectile points and stone implements have been found nearby. Castaneda (1936) described De Espejo's visit in 1583:

The little party of Espejo rested for a day and then proceeded up the stream for six leagues, camping that night at the source, where they found some springs, perhaps present Toyahvale in the vicinity of Balmorhea in Reeves County. On the way they met many Indians, who in dress and customs resembled the Patarabueyes, apparently a division of the Jumanos.

In the nineteenth century several mills were powered by the water. Reeves County Water Control and Improvement District No. 1 was formed in 1915, irrigating 4,900 hectares, with most of the water derived from San Solomon Springs, but using also that from Giffin, Phantom Lake, Saragosa, and Sandia Springs. The area irrigated with spring water is now somewhat less. The discharge of San Solomon Springs is shown on the accompanying graph. The flow appears to be decreasing, but not as markedly as that of Phantom Lake Springs, seven kilometers west-southwest in Jeff Davis County, which are 60 meters higher in elevation. The largest recorded discharge of San Solomon Springs was 2,010 lps on October 7, 1932.

Visitors may stay in cabins or a camping area adjoining San Solomon Springs. Within the canals encircling the cabins are found several rare and endangered species of small fish. These include the Comanche Springs pupfish, whose original habitat at Comanche Springs (Pecos County) is now gone, and the Leon Springs pupfish, from the now-dry Leon Springs in Pecos County. The springs also harbor the endangered Pecos gambusia or mosquito fish, a small crustacean, and two kinds of aquatic snails which apparently live nowhere else. All of these species depend upon the springs not only for their lives, but for the lives of their species. A historical marker is located here.

**Giffin Springs (16)**, smaller than San Solomon Springs, rise at about the same elevation just across Highway 17 from Balmorhea State Park. These artesian springs on the Balmorhea ranches, are very similar to San Solomon Springs, rising from the same aquifer. The water is used for irrigation, partly by the Reeves



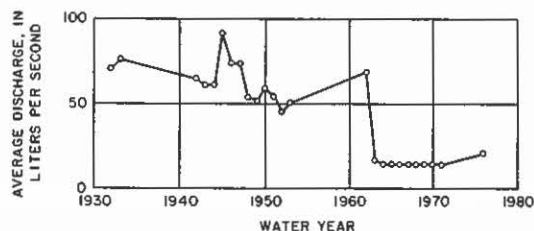
#### Discharge of San Solomon Springs.

County W.C.I.D. No. 1. Available discharge records, in lps by water years, follow:

1919	110	1957	120
1922	130	1958	130
1923	100	1959	110
1925	91	1960	140
1932	130	1961	110
1933	150	1962	120
1941	160	1963	140
1942	140	1964	120
1943	150	1965	120
1944	110	1966	100
1945	170	1967	110
1946	150	1968	96
1947	130	1969	88
1948	130	1970	85
1949	130	1971	93
1950	120	1972	88
1951	140	1973	93
1952	140	1974	82
1953	120	1975	99
1954	110	1976	91
1955	140	1977	65
1956	120	1978	74

The highest recorded discharge was 195 lps on August 14, 1945. As may be seen from the above table, the spring discharge appears to be gradually declining.

**Sandia (Watermelon) Springs** are just east of Balmorhea. They appear at an elevation of 980 meters in groves of salt cedar. **East Sandia Springs (14)** at the base of the western slope of the Brogado Hills, are about twice as large as **West Sandia Springs (13)**. White, Gale, and Nye (1941) reported that in about 1900 the West Sandia Springs were two kilometers farther up the valley. Very likely De Espejo's company stopped to refresh themselves here in 1583. In 1915 Sandia Springs were portrayed as **Patterson Springs**



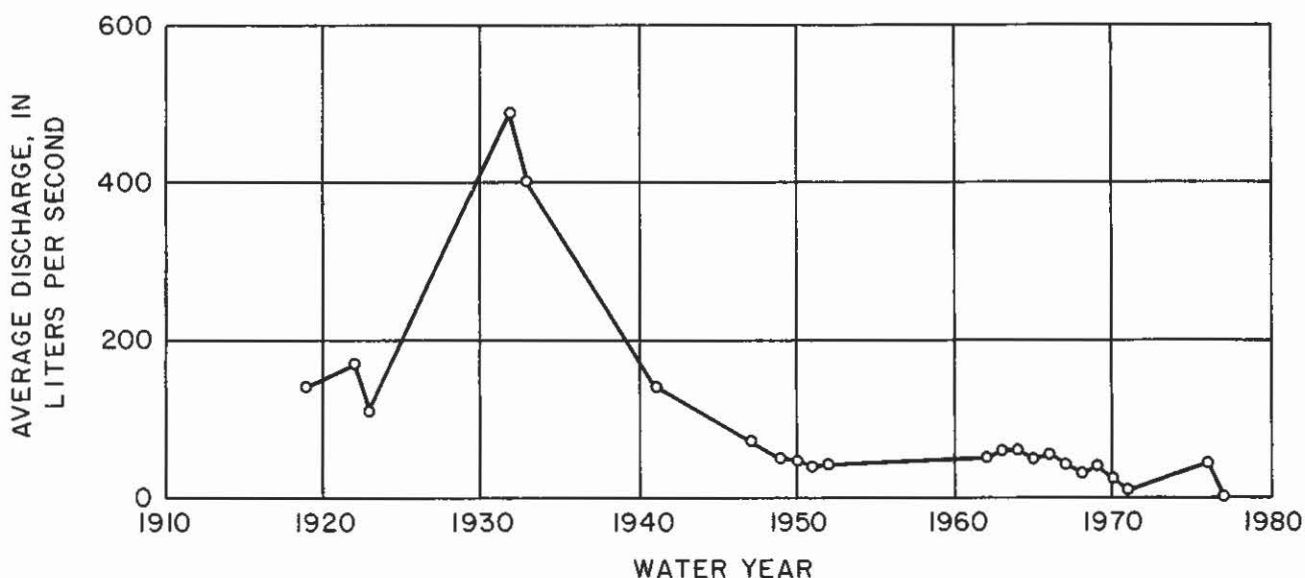
#### Discharge of Sandia Springs.

by the U.S. Army Engineers on their *Progressive military map of the U.S.* This was in deference to Edgar Patterson who at that time lived at the springs, according to D. H. Kingston of Balmorhea.

Sandia Springs flow from alluvial sand and gravel, but the water probably is derived from Comanchean limestones underlying the alluvium. Discharge records are shown on the accompanying graph. The 1976 value includes 14 lps from East Sandia and 7 from West

#### Part of the discharge of San Solomon Springs.





*Discharge of Saragosa Springs*

Sandia Springs. The maximum recorded discharge was 125 lps on August 14, 1945. It is apparent that the flow of these springs is declining.

**Saragosa and Toyah Creek Springs (12)** are now located near the Highway 2903 bridge at Balmorhea. They were formerly four kilometers upstream, or southwest of Balmorhea, but with a decreasing flow only the lowest springs now flow. They also flow from alluvial gravel and sand, and probably from the underlying Comanchean limestones. They were once used to power a grain and flour mill. Discharge measurements are shown on the accompanying graph. Obviously the flow has greatly declined. The maximum recorded discharge was 849 lps on November 6, 1932.

Seventeen kilometers west of Saragosa were Dobe or **Spittgarber Springs (23)**. They discharged 0.95 lps in 1947 but dried up before 1958. They were depicted as **Ojo Hermano** (Brother Spring) on an 1897 U.S. Geological Survey topographic map.

**VH Springs (5)** were eight kilometers farther north at the VH ranch headquarters. They flowed from bolson gravel. In 1958 they had a considerable flow of slightly saline water, being used to irrigate 12 hectares (30 acres). They are now dry, the spot being marked by a grove of dead cottonwoods.

## REFUGIO COUNTY

As most of Refugio county is quite flat, there has been little opportunity for springs to develop. They are

more numerous in the northwestern part where there is some topographic relief, and along the Mission River almost to Copano Bay. Otherwise, near the coast springs and seeps have always been scarce. In Newcomb's words (1961),

There is little rainfall in winter, so little that in some years it would seem the Karankawas must have been hard-pressed for drinkable water. Early Anglo-American settlers were perplexed by the fact that the Karankawas always seemed to have an adequate water supply while they could find but little.

The Karankawas and Kopanos were expert fishermen, using both bows and arrows and nets. Deer, antelope, bear, some bison, and javelinas frequented spring-fed creeks before the first explorers arrived. Many of these animals are gone now, and those that remain are no longer allowed to reach the gigantic size to which they formerly grew. In 1834, for example, a pelican with a 2.3-meter wingspan was shot. The springs and spring-fed streams and lakes still provide a haven, especially in winter, for thousands of geese, ducks, sandhill cranes, egrets, hawks, and other fowl. The sandier areas, where springs and seeps are more apt to be found, are usually covered with motts of live-oak, blackjack, post-oak, and other trees.

It was natural that the earliest explorers should seek out the best fresh-water springs for the establishment of settlements. The various Refugio missions in Calhoun and Refugio Counties were all located purposely where good spring water was available. On the other hand,



towns like Copano were abandoned because of the scarcity of drinking water.

All of the county is underlain by Quaternary formations. The Beaumont formation in the southeast portion is largely composed of clay, with only a few thin beds of water-bearing sand. But the Lissie formation of the northwest area is largely sand which makes a good aquifer.

Recharge to the aquifers has been considerably damaged by overgrazing, chiefly in the era of the cattle barons in the late nineteenth century, but continuing to the present. In large areas around watering troughs the grass was killed by being tromped into the ground by thousands of cattle. This destruction of the thick organic mulch which formerly absorbed rainfall, and "puddling" of the surface soil, has greatly reduced the ability of the soils to take in water and recharge the underlying aquifers. In addition, around the turn of the century many flowing wells were drilled which wasted much water. Most of them have now stopped flowing because of reduced hydrostatic pressure. In more recent years well pumping has further drawn down the water table, to as much as 30 meters below the surface in the western part of the county. As a result many former springs have ceased flowing or flow only in wet periods.

The spring water is generally of a sodium chloride type, fresh to slightly saline, very hard, and alkaline. It is more apt to be fresh in the Lissie sand area in the northwest portion.

The writer visited most of the springs during the period January 31-February 4, 1977, after several months of above-average rainfall.

Historically the most important springs in Refugio County are the **Mission Springs (10)** in Refugio. Probably the Mission was moved to this location in 1795 because of the abundant supply of fresh water which the springs could furnish. They were frequented by the Karankawa and Kopano Indians before that time. On February 1, 1977, two groups of very small springs were flowing in wet weather, but ordinarily they no longer flow. The largest group is on the northeast bank of the Mission River between Highway 77 and the railroad to the east. Here, immediately below the mission location, a group of very small springs from caving sand were producing 0.35 liter per second of water which flowed into the river. Field tests showed the water to be fresh. Numerous horsetails, water pennyworts, and plantains grow around the springs.

The other group of Mission Springs are a short distance upstream, just west of Power Street on the bank of the river. These were discharging 0.25 lps of water high in iron and manganese on February 1, 1977. A



*Mission Springs.*

grove of anacua and hackberry trees surrounds them. In this location the Lissie sandstone and sand beds dip upstream or northwest, rather than the usual dip toward the Gulf. This indicates that a fault is probably present in the vicinity, which is the reason that springs are present. Mission Springs were important during Texas' fight for independence in 1836. Colonel Ward's Texans obtained water from them during a battle at the mission.

Numerous small springs flow from the Lissie sand northwest of Refugio. Some, five kilometers west of Refugio (7), were flowing 2.1 lps at the time of the writer's visit from sand on top of a soft sandstone with numerous iron and manganese concretions. Others (6) six kilometers northwest of Refugio were yielding 6.5 lps from sand on top of a clay bed. Ten kilometers northwest of Refugio, at latitude 28°21' and longitude 97°21', a flow of 1.5 lps from numerous seeps (8) was observed. Fourteen kilometers northwest of Refugio, at the Goliad County line and longitude 97°20', many seeps (9) from sand and silt were producing 2.2 lps. Many other springs doubtless occur in this area, but most fail in dry weather.

**Hartman Springs (1)** are four kilometers north-northwest of Austwell on Roger Jackson's farm. Here many seeps issue from a layer of sand on top of clay. They produced 0.13 lps in 1937 and were flowing at this rate on January 31, 1977, also, after much rainfall. As a shallow well is located close to the springs, they cannot be expected to flow except in wet weather. The ancient (1588) Spanish fort, vestiges of which La Salle found, may have been near these springs. In 1852 the last Indian fight in the county took place here. The water is slightly saline but drinkable (see table of Selected Chemical Analyses).

Near Mission Bay at latitude 28°11' and longitude 97°11' were **Hynes Springs (2)**, on Dennis O'Con-

nor's ranch. They were probably used by the second Refugio mission here in 1794, and later by residents of the nearby Port Preston. According to O'Connor they have not flowed for 70 years or more. They flowed from sand and shell deposits in a circular hole 3 meters in diameter at the foot of a 7-meter-high bluff. The Kopanos had a campsite here, and artifacts and burials indicate that a more ancient people also made use of the springs.

Wet-weather seeps occur in other parts of the county. One such location is on Highway 77 just east of the Aransas River crossing in the southwestern part of the county (5). Another (4) is on Highway 2678 north of the Mission River crossing.

## ROBERTS COUNTY

The springs of Roberts County usually issue from Tertiary Ogallala sand and gravel, which can be up to 200 meters thick. The formation dips gently toward the east. The underlying Permian shales are rarely exposed. In Hutchinson County to the west most springs appear at the top of this impervious formation. The near lack of Permian outcrops in Roberts County is one reason why springs here are small and scarce. Some springs run from Quaternary dune sand which overlies the Ogallala.

As long as 15,000 years ago Paleo-Indians camped at the springs of the county. At the C. R. Cowan ranch eleven kilometers northwest of Miami, mastodon bones have been found associated with spear points used by these early Americans. In historic times Indians were still found camping at springs and spring-fed creeks.

Plowing of steep hillsides and overgrazing have resulted in huge gullies, many of which are still not healed. Sediment from this erosion has choked many stream channels and buried some springs. In addition the water table has declined dramatically. As a result most springs have weakened or dried up.

Cottonwood, willow, salt cedar, and chinaberry trees, grapevines, and plum thickets depend upon the spring waters for their lives. Around the turn of the century many sawmills cut the cottonwoods. They have come back to some extent, but not in their former size and numbers. Although the buffalo, bear, and panther are gone, many other animals still rely upon the springs. These include beavers, deer, antelope, turkeys, kill-deers, waterfowl, and fish.

The spring waters are of a calcium bicarbonate type, generally fresh, alkaline, and very hard. The content of silica or fluoride may be high.

Most of the writer's field studies were made during

the period June 12-17, 1978. As much rain had fallen during the preceding several weeks, the observed spring discharges are probably above normal for this season.

In the northwest corner of the county at latitude 35°58' and longitude 100°57' were **Whitsell Springs (17)** on Charlie Lips' ranch. In 1939 they produced 0.95 liter per second from Ogallala sand and gravel on Permian shale, with "white deposits," probably calcium bicarbonate or sulfate. They are now dry.

Eight kilometers north-northwest of Whitsell Springs were some others (16), now on the Ruth Wilson ranch. They evidently were starting to fail in 1939, as their discharge varied from 1.9 lps to 0 during that year. In a cedar-lined valley bordered by caprock cliffs, they have been dry for many years.

In writer Laura Hamner's words,

In 1889 a lovely spot on Indian Creek near five springs and a huge grove of cottonwoods was selected as the county seat.

This spot, the now-vanished town of Pamell, was at latitude 35°53' and longitude 100°48' in northern Roberts county. One group of springs here, **Graveyard Springs (11)**, still produced 0.35 lps in 1978 from Ogallala sand on Bill Tolbert's ranch, and flowed 500 meters down Indian Creek. According to Tolbert, the others all dried up during the drought of the 1950s. A sawmill cut many of the cottonwoods between 1910 and 1920, but most have come back. If the water table continues to drop, however, they can be expected to die. The remains of a mammoth, camel, and large turtle, such as the Paleo-Indians hunted many thousands of years ago, have been found here. Several irrigation wells pump nearby. The springs dry up during the irrigation season. Tolbert is trying to conserve the spring flow by building dams. Beavers work in the rushes along Indian Creek.

Five kilometers west of Pamell are **Chicken Springs (12)**, feeding Chicken Creek on Joe Tolbert's ranch. The creek and springs were named for the prairie chickens which were once so numerous here. In 1903 J. D. Lard's sawmill cut the huge cottonwood trees which once grew here, some 23 meters high. According to Tolbert, many other springs poured out in this vicinity when he was a boy around 1908.

According to P. C. Ledrick, until 1928 Chicken Springs flowed continuously three kilometers farther up Chicken Creek than at present, and an Indian village of teepees was located there in historic times. The channel

at this upper location is now filled with sand. On October 23, 1939 and on June 15, 1978 (after much rain), there was a discharge of 1.3 lps at Highway 70. The flow usually stops in summer, leaving only a few holes of water.

Eight kilometers northeast of Parnell were **Three Corrals Springs (5)**, feeding Three Corrals Creek on D. L. Hale's ranch. In 1739 Pierre and Paul Mallet may have stopped here on their journey down the Canadian River. In 1939 about 1.3 lps trickled from seeps along the creek. Now the springs are dry, but some cottonwoods still survive. Several irrigation wells pump upstream.

**Waterfield Springs (3)** are in the northeast corner of the county at latitude 35°54' and longitude 100°34'. They supply a small lake and feed Wagon Creek on Jim Waterfield's ranch. The largest springs remaining in the county, they produced 0.63 lps from Ogallala sand on October 15, 1939, and the same amount, after much rain, on June 14, 1978. The 1978 discharge from an elevation of 775 meters coursed 700 meters before disappearing. In 1939 several other springs existed on Wagon Creek, but they are now dry and the channel filled with sand. The remains of an old bridge may be seen at the county road near the mouth of Wagon Creek. Not even a culvert is needed now, as the creek seldom flows. (See Plate 11, d). Dark gray soils around the springs indicate that there was once a large spring-fed bog here. Cottonwoods, willows, salt cedars, plum thickets, grapevines, and rushes thrive at the springs.

**Home Ranch Springs (4)** were nine kilometers northwest of Waterfield Springs. They once fed Home Ranch Creek on the John McMordie ranch. They flowed in 1939, but the springs and creek channel are now buried in sand. Horse Creek to the west is similar. Four-wheel drive is often needed to cross its dry sand bed at the county road.

Seven kilometers south of Waterfield Springs were some small springs (2) on the R. A. Flowers ranch. They were dry before 1947. Similar springs (1) once trickled on the Vernon Flowers ranch three kilometers farther west. They also have long been dry, and are now marked by a windmill and stock tank.

Two kilometers east of Miami small springs (8) formerly ran on J. W. Thompson's property. They are reported to have dried up around 1958.

**Nickels Springs (7)** are three kilometers south of Miami on the John Smith ranch. They are now only a pool of water beneath a caliche overhang in a ravine in Ogallala sand and sandstone. Swallow nests adorn the cliffs. Cottonwoods and willows shade the pool, where blotched water snakes may be seen. The similar **Cun-**

**ningham Springs** are one kilometer farther south.

In 1879 when Marion Armstrong and his family built a dugout stage stand at Miami, Red Deer Creek flowed continuously. In 1939 it was reported still to be flowing near the Gray County line. Several springs (10) ran here on what is now the Locke Cattle Company ranch. The creek has been dry for many years, but cottonwoods still survive along its banks.

In 1939 several springs (6) ran on Ellis Locke's ranch in the headwaters of Indian Creek, 12 kilometers south of Parnell. One flowed from beneath a cottonwood tree. They have long been dry.

Three kilometers farther north Frank and Harriet Razor built their cabin in 1902. A spring (9) on Sand Creek supplied water for their home. According to Frank Russell of Miami, an Indian village once existed here. Human skeletons and projectile points have been found. The spring was dry long before 1938 when Russell lived there.

Sixteen kilometers west-northwest of Parnell are **Tallahone Springs (15)**. Feeding Tallahone Creek on Albert Reynolds' ranch, they are now only swampy areas, some of which have been deepened to form pools for stock. According to Reynolds, the water table is declining in this area. The creek formerly flowed from at least five kilometers farther upstream (south). Cottonwood trees extend up past this point. The original giant virgin cottonwoods were all cut by a sawmill in 1902. Many rushes, cattails, and salt cedars grow in the sand-choked channel.

**Polecat Springs** are very small springs six kilometers east-northeast of Tallahone Springs. George Watson of Miami, who knows these springs well, says they now dry up in summer.

**Garden Springs (13)** are in a bluff on the south side of the Canadian River 21 kilometers west-northwest of Parnell. On Don and Fran Morrison's ranch, they were once very strong. Lt. A. W. Whipple in 1853 called this place Spring Creek in his report (Archambeau, 1971).

The one at the mouth of which we are encamped, called Spring creek, contains a rivulet of pure water, flowing beneath a grove of alamos. The valley abounds in grapes, which are sweeter, perhaps because riper, than those gathered below. Had they been cultivated, they could hardly have been produced in greater profusion.

On November 20, 1939, Garden Springs produced 6.3 lps from many seeps in Ogallala sand and gravel. On June 16, 1978, the discharge was only 0.06 lps, which ran 50 meters through a sand-choked bog before disappearing. Rushes and horsetails cover the site,



shaded by large cottonwoods and other trees. The visitor is apt to see antelope racing across his path, and many deer.

About 1.5 kilometers farther southwest are **Henry Springs (14)**. Here, according to Fran Morrison, Billy Dixon, a noted scout of Adobe Walls fame, proposed to Olive King in 1894. The Lewis family settled at the springs around 1900. In 1978, 0.03 lps trickled through a pipe into two steel tanks from Ogallala sand and gravel. Frogs and snakes live among the water milfoil and algae. Cottonwoods, grapevines, and plum thickets fringe the site.

## ROCKWALL COUNTY

Most of Rockwall County's springs issued from Wolfe City sand and Marlbrook marl, in a strip along the bluffs of the East Fork of the Trinity River, on the western edge of the county. Farther east the formations are mostly clay, which cannot carry appreciable quantities of water.

The springs were favorite haunts of prehistoric people. Artifacts, burials, and shell concentrations recovered from archeological sites now beneath Lake Ray Hubbard indicate that early Americans lived here at various times for at least the last 4,000 years. The springs supported an abundant array of plant and animal life. Wild turkeys, deer, geese, and ducks were numerous along the East Fork. Most creeks flowed continuously and Squabble Creek, north of Rockwall, was frequently impassable because of high water.

All this has changed now. Flowing wells drilled around the turn of the century greatly lowered the water table. As a result most springs have dried up. Others have been covered by the waters of Lake Ray Hubbard. Most of the wildlife which formerly frequented the springs is now gone.

The water is, or was, of a sodium bicarbonate type, fresh, moderately hard, and alkaline. Most of the writer's field studies were made during the period November 3-7, 1977.

Near the intersection of Clark and Rusk Streets in Rockwall are **Butler Springs (1)**. Here Butler Institute was established in 1853. The springs, now on Robert Peoples' property, trickled 0.07 liter per second in 1977 from Marlbrook silt at an elevation of about 170 meters. Covered with water cress and marsh purslane and shaded by willow trees and honeysuckle vines, the water ran about 200 meters before disappearing. The springs have been covered with much sediment from eroding fields upstream.

Katy Lake (3), three kilometers south of Rockwall,

was built in 1901 as a water supply for the railroad. The spring-fed, clear water was very popular for swimming, fishing, boating, and picnicking. There was also a spring below the dam, just south of where Highway 740 crosses the railroad, where travelers stopped to drink from a gourd. Emmet Young remembers this spring before the dam was built. No doubt it flowed more copiously after the dam was constructed just upstream. The lake, on Billy Peoples' property, filled up with sediment from man-induced erosion, and has now been drained. Willows and cottonwoods mark the sites of the long-dry springs.

**Sulphur Springs (2)** were on the east bank of the East Fork of the Trinity River just south of Interstate 30. An Indian village and a mound containing at least seven 13th century skeletons were located 0.4 kilometer downstream. The several springs evidently were much used in prehistoric times. Early settlers came great distances to picnic and fill jugs with the mineral water, which was reputed to have healthful properties. According to Emmet Young, a long-time resident here, the springs were strong and never failed. They probably flowed from Wolfe City sand, perhaps along the same fault zone which caused the underground rock walls in and near Rockwall. In 1967 they were covered by Lake Ray Hubbard.

**Willow Springs (4)** are 10 kilometers south of Rockwall in the Heath community. Here John Heath and his family settled in 1846. The Heath community was known as Willow Springs in early days. The Willow Springs church was established here in 1874 and Willow Springs school in 1887. In the early 1950s Highway 1140 covered the springs proper, according to Pastor Dick Sisk. Now there are only intermittent seeps in cattails, still shaded by willow trees.

## RUSK COUNTY

The springs of Rusk County have been used for many thousands of years by early Americans. First a hunting and gathering people camped at the springs. Then agricultural mound builders established villages near the water. And at the dawn of historic times the Caddoes were living in villages of thatched homes here.

Most of the springs issue from Tertiary Eocene sands, primarily the Wilcox, Carrizo, Reklaw and Queen City. These sands dip mostly toward the west into the East Texas embayment at about three meters per kilometer. The Mount Enterprise fault zone, which crosses the southern part of the county from east to west, has a controlling effect on many springs.

Most streams are spring-fed and run the year

## RUSK COUNTY

around. The groundwater table has not suffered greatly from man's activities except in areas of heavy pumping such as around the cities. Some springs have been buried beneath sediment from past accelerated erosion from plowed fields. Partially healed gullies can often be seen in wooded areas. Little land is now in cultivation. As there are so many springs in the county, only those with some historical or other importance are mentioned here.

The spring waters are generally of a sodium bicarbonate type, fresh, soft, and of neutral pH. The content of iron may be high.

Most of the writer's field studies were made during the period January 9-14, 1978. Although an ice storm occurred during this time, the observed discharges are believed to be about average.

Several springs in Henderson were very important in early times. Near the intersection of Crim and Hodge Streets in west Henderson are **Crim Springs (1)**, which gave their name to the surrounding community. They discharged 0.07 liter per second in 1978 from Carrizo sand.

Farther south on Hardy Branch, just north of the High School and south of the cemetery, are the **High School Springs (37)**. This was a popular campground in early days, and fairs were held here. In 1978 they discharged 0.55 lps from Wilcox sand. About another kilometer south was Shawnee Town, where the Indians lived by the spring-fed creek until they were driven out in 1839.

At the site of the old Yates place in Yates Park in east Henderson are **Yates Springs (2)**. Flowing 0.30 lps from Carrizo sand in 1978, they were reportedly formerly more numerous and larger.

In north Henderson at the Henderson Clay Products Co. plant is **Morris Spring (36)**. Here Judge William Morris (for whom Morris County was named) built his home in 1849 amid rose bushes, jonquils, and apple trees. It was ably described by Mrs. Ned Morris, a noted local writer, as follows:

The house had been built near a spring flowing out of a hillside, and the mouth of the spring was walled with rock to insure a continuous supply of fresh running water. Here were kept the earthen crocks of freshly churned buttermilk, always ready for the traveler who stopped to rest.

The grave of Judge Morris' mother is about 100 meters east of Morris Springs. The discharge was 0.75 lps in 1978 from Carrizo sand 70 meters northeast of the Henderson Clay Products heliport. There is much iron ore, and Homer Brice, owner of the brick plant, has



*Morris Spring after an ice storm.*

moved one large, strangely shaped piece to the plant office. **Beaver Springs** are similar but smaller springs five kilometers west-northwest of Henderson.

Seven kilometers northeast of Overton on the west side of Leveretts Chapel is the 1840 Leverett house. The springs (47) near which the house was built are just across the road to the north. An Indian village and mound 1.6 kilometers north have yielded many artifacts. In 1895 a camp meeting was held at the springs. A discharge of 0.075 lps of iron-bearing water from Reklaw sand still fed a pond in 1978. A smaller spring just east of the house provided domestic water beginning in the 1870s, but dried up for the first time in 1977. According to owner Donald Leverett, every old home in this area was built near a spring.

At the New Prospect church eight kilometers northeast of Henderson are some well-known springs (46). According to Mrs. Gordon Brown of Henderson, they have been used for gatherings for 100 years. Similar small springs (23) flow at Millville, 14 kilometers north-northeast of Henderson.

At Tatum are several important springs. **White Oak Springs (43)** were 500 meters southeast of town on Mrs. Osborne Bezanson's property. Known for their iron and sulfur content, the waters were used medicinally for many years. Mr. T. G. Hemby, who guided the writer to the springs, remembers when the large tile pipe was placed around them in 1903. In 1914 Deussen reported a discharge of 1.9 lps from Wilcox sand. Now there are only seeps with water-shield-covered pools. The white oak which marked the springs is gone, and replaced by several sweetgum trees.

Near the center of Tatum on Clarence Furr's property are **Parish Springs (45)**. According to Hemby they were formerly bricked up and the water used in the boilers of a sawmill, gristmill, and cotton gin. The flow of iron-bearing water is said never to have failed. Deussen reported a flow of 0.38 lps in 1914. On January 13, 1978, the discharge was 0.06 lps. The springs are now covered with honeysuckle vines.

**Tatum Hill Springs (44)** are 500 meters southwest of Tatum on the A. O. Menefee estate. Here in the 1840s, according to Hemby, Mrs. Reel drove off a bear which threatened her baby. Located on an old Indian trail, on Trammel's Trace to the Spanish Fort Tenox-

titlan in Burleson County, and on the old Tatum-Henderson road, the springs were much used by travelers. Now these very small springs supply two ponds, the upper of which contains very clear water, fringed with water pennywort.

Twelve kilometers east of Henderson on a county road 500 meters north of Highway 79 are **Leopard Springs (42)**. They no longer flow from their brick spring box at which travelers often stopped. Seeps of about 0.05 lps still emerge at a lower elevation from Wilcox sand. A shallow well at the roadside with bucket and chain and a pan for drinking have replaced the springs. Four kilometers west at Oakland are the small **Sand Springs (32)**.

Three kilometers southwest of Chapman and 500 meters south of Hall cemetery are **Hall Springs (39)**. Deussen noted their "soft" water in 1914. In 1978 they produced 0.32 lps from Wilcox sand. At Willow Springs church two kilometers southeast of Chapman are the similar **Willow** or **Graveyard Springs (34)**.

Near Pinehill (six kilometers southeast of Chapman) several springs issue from Wilcox sand. One kilometer west and across the road from the Baptist cemetery are **Holly Springs (41)**. Two kilometers southwest on Alvin Mansinger's farm are **Zuber Springs (30)**. Located on the old Trammel's Trace, they produced 1.3 lps on January 10, 1978. Three kilometers south-southwest of Pinehill on Highway 1798 are are **Buzzard Roost Springs (29)**. (See Plate 2, d). In 1978 they ran only 0.06 lps. Four kilometers west of Pinehill are **Pine Grove Springs (40)**. They were used by the 1850 Pine Grove Meeting House, which still stands nearby. In 1978 0.55 lps trickled from Wilcox sand among many sweetgum trees.

Seven kilometers southwest of Chapman, near the Hunt cemetery, are **Pine Springs (33)**. The group produced a flow in 1978 of 1.3 lps at Highway 2867, from Carrizo sand.

**Tanyard Springs (38)** are nine kilometers south-east of Henderson, partially on Chester Sockwell's farm. They are said to have been used by a tannery during the Civil War. About 0.75 lps originated from Carrizo sand in 1978. **Mission Springs (24)**, three kilometers northwest and 500 meters east of Mission church, are quite similar.

Near Brachfield, seven kilometers northeast of Minden, are several historic springs. One kilometer west on Mrs. Arlen Orr's property are **Welch Springs (19)**. In 1847 Robert Welch built a log cabin near these "springs of purest water." According to Mary Frank Dunn, a historical authority in this area, there were

seven main springs. One, used for drinking water, was equipped with a windlass which brought a bucket of water about 100 meters from the springs to the kitchen window. Another, called the "wash spring," was used to wash clothes.

A third, whose waters contained much sulfur and iron, was greatly valued for its curative powers. People came great distances to camp or stay at the hotel here and drink the water. The sulfur spring is now enclosed in a section of large concrete pipe. For many years the springs were a gathering place on Sundays. In 1904 and 1905 camp meetings were held here. Spanish moss formerly draped the trees, but disappeared during the severe winter of 1898. The combined flow from Wilcox sand on January 11, 1978, was 3.5 lps, which fed Welch Springs Branch.

Other important springs near Brachfield include **Pleasant Springs (35)** at Patrick (two kilometers northeast), **Zion Hill Springs (20)** at Zion Hill church (three kilometers west), and **Wood Glen Springs (22)** five kilometers northwest. **Maple Grove Springs (25)** at Minden are similar.

Three kilometers north of Caledonia are **Eulalie Springs (16)**, on Pallie Bryce's farm. Named for the former community of Eulalie, they were described by Deussen in 1914 as supporting a local resort. The iron-bearing water was much employed by early residents. On January 12, 1978 the several springs were overgrown in woods, producing 3.2 lps from Carrizo sand along a fault.

Seven kilometers north-northeast of Mount Enterprise are **Gum Springs (17)**, which feed Gum Springs Branch. Formerly much utilized by surrounding residents, the water now collects in channels and pools filled with milfoil. On January 13, 1978, 3.5 lps issued from Carrizo sand along a fault. Three kilometers farther north-northeast are the small **Shiloh Springs (21)**.

**Union Springs (18)** are eight kilometers northeast of Mount Enterprise, just east of the Union Springs church. They were once used by the Union Springs school, now disappeared. One of the springs is enclosed in a section of large concrete pipe. The flow, from Reklaw sand, was 0.15 lps in 1978.

Twelve kilometers southeast of Mount Enterprise are **Fenton Springs (15)**, which feed the branch of this name. The Mount Olive school formerly used water from one of the springs, which is now on D. H. Newman's property.

Eight kilometers southeast of Mount Enterprise are **Star House Springs (12)**, on the Gordon Strong



property. They were named for a house with a star on it, according to Mr. Strong. An old cemetery here dates back to the 1860s. The Cairo and Northern Railroad once passed through the community, which was called Strongfield Switch. A school used the spring water at one time. The springs seeped 0.05 lps from Carrizo sand in 1978 at the foot of a large pine tree, amid much swamp grass and magnolias. Partially healed gullies in the woods indicate that the surrounding land was once plowed.

**Mineral Springs (14)** are five kilometers southeast of Mount Enterprise on Temple Lumber Co. property. Their waters were valued in the 1880s as a cure for dropsy and other diseases. According to Strong, a turpentine works was located here, and camp meetings were held at the springs in summer. In 1978, 0.50 lps trickled from Wilcox sand, soon to disappear again under leaves and sand.

**Gatlin Spring (13)**, one kilometer southeast of Mount Enterprise, was once valued as a mineral spring.

**Mount Zion Springs (26)** are small springs four kilometers east-northeast of Mount Enterprise, at Camp Ground. **Haltom Springs (28)**, four kilometers north-northwest of Mount Enterprise, were important in the past.

**Sand Springs (50)** are seven kilometers south-southwest of Mount Enterprise, on Mrs. Martha Akin's farm near the Isabel Chapel church in the Sand Hill community. In 1826, during the Fredonian Rebellion against the Mexican government, it was proposed to draw a line from Sand Springs west to the Rio Grande, according to R. B. Blake (1953). It was to serve as a boundary between the Indians on the north and the settlers on the south side. But since there were already many settlers north of the line, the plan was never put into effect. Several old roads led to the springs. John Helpenstell, who guided the writer to them, remembers when the Sand Hill school and church, as well as many residents in the surrounding area, used the spring water, until the 1920s. On February 11, 1978, the several springs discharged 0.72 lps from Carrizo coarse sand. In a deep wooded ravine the spring waters run about 50 meters, disappear into sand for about 50 meters, and then resurface.

**Stockman Springs (10)** are five kilometers west-northwest of Mount Enterprise, on Thelma Cormier's property just south of Highway 2496 and west of the East Fork of the Angelina River. In 1833 Henry Stockman received a land grant which included the springs. They were formerly much larger, flowing from a deep hole surrounded by quicksand. According to Madia

Jaggers, a noted Henderson historian, Stockman drowned in the springs along with a yoke of oxen. The iron-bearing water issued from Reklaw sand at about 0.65 lps in 1978. The hole has been filled with modern sediment. The old spring-box wall has largely collapsed, and water pennywort covers the pools.

A few kilometers north is the spring-fed **Double Springs Branch**. According to John Moore, who lives nearby, none of the many springs along the branch are now known as Double Springs.

**Sulphur Springs (9)** are nine kilometers west-southwest of Mount Enterprise on the Penny estate. According to Dufus Owens, a nearby resident who hunts coyotes, foxes, and raccoons, many people still come to these springs for water. In 1687 Henri Joutel and part of La Salle's party may have stopped here en route from Fort St. Louis in present Victoria County to Quebec, Canada. The source of Sulphur Springs Branch, Sulphur Springs were described by Deussen in 1914 as having a "large flow." On January 11, 1978 they produced 1.8 lps from Sparta sand along a fault. Water pennywort, mint, and marsh purslane fringe the water.

Ten kilometers east-southeast of New Salem, on the Emmett Lowry farm, is Monte Verdi plantation house, built by Julien Devereux in 1849. The house and its surroundings have been well described by Dorman Winfrey, director of the Texas State Library. In a wood 400 meters north of the house and near the former slave quarters are the springs (7), which were much used. One day in 1852 Devereux killed a panther and a bear here. In 1978 the springs produced 0.11 lps from Sparta sand. **Cool Springs (31)** are similar very small springs at New Salem.

**Indian Springs (3)** are 21 kilometers southwest of Henderson and one northwest of the Townley sawmill, on Edgar Ashby's farm. A Cherokee village was located on a ridge 100 meters southeast of the springs. A historical marker commemorates the Cherokee Treaty, said to have been signed here by Sam Houston and Chief John Bowles in 1836. Unfortunately the treaty was later broken by the white settlers and the Indians killed or driven from the area. A few stones remain of an old fort which stood 50 meters southeast of the springs. One of the springs is enclosed in a section of concrete pipe in an oak and walnut grove. In 1978 the flow was 0.07 lps from Carrizo sand near a fault. Water pennyworts cover the pools.

**Good Springs (6)** are in the Good Springs community, 15 kilometers southwest of Henderson, on Marvin Skinner's farm. The Good Springs school, now

gone, formerly used the spring water. The church, now moved 500 meters southwest, used them for baptizing, according to Skinner. In 1978 the iron-bearing water poured at 1.3 lps from Carrizo sand at an elevation of 120 meters, feeding Gin Branch.

Five kilometers west of Good Springs are **Big Springs (4)**, in the community of that name. The main springs, enclosed in a wooden box, are still used by many residents, although they were relied upon much more in the past. They trickled 0.14 lps from Carrizo sand in a wooded area in 1978.

A second **Gum Springs (5)** are six kilometers north-northwest of Good Springs, on Beatrice Fletcher's property. They were formerly utilized by the Gum Springs school and nearby residents. The church which stood here has moved two kilometers south. Now only 0.05 lps seeps from Carrizo sand. Sweetgum trees surround the springs, which feed a stock pond.

## SABINE COUNTY

The many fine springs of Sabine County were used for thousands of years by the Hais tribe of the Caddo confederacy and their predecessors. They usually built their villages of circular thatched houses near springs, cultivated corn and other crops, and traveled the Sabine and other rivers in large canoes. The early European explorers made good use of many of these springs also. They included the French Louis Juchereau de St. Denis and the Spanish Don Martin de Alarcon and San Miguel de Aguayo.

The springs flow chiefly from Eocene, Oligocene, and Miocene sands. Groundwater levels have fallen in most parts of the county because of increased pumping. Large-scale deforestation has also played havoc with the natural recharge which formerly occurred, by destroying the thick layer of water-holding mulch and organic matter. As a result many former springs are now dry.

The spring water is usually of a sodium bicarbonate type, being fresh, soft, and of neutral pH. The content of iron, silica, or sulfate may be high. Most of the writer's field studies were made during the period January 8-13, 1976.

Seven kilometers northwest of Hemphill, at the junction of Highways 1592 and 2784, are **Conn Springs (2)**. In a grove of cypress trees with much water cress, the springs flow from several large concrete pipes in which they have been enclosed. Issuing from Sparta sand, the water tastes fresh, but obviously con-



*Lobanillo Springs.*

tains much iron. Discharge records are as follows, in liters per second:

May 23, 1942	0.32	Jan. 9, 1976	0.32
Dec. 2, 1964	0		

Another group of springs about 100 meters east also discharged 0.32 liter per second in 1976. The springs were much used by early settlers 100 to 150 years ago.

**Sulphur Springs (3)**, issuing from the base of the Carrizo sand, are 11 kilometers west of Milam, at latitude 31°27' and longitude 93°57'. For a long period residents came great distances to obtain this water, which was valued for its healthful properties. Many people camped at the springs for weeks at a time, filling bottles and barrels with the water before they left. They were probably used by Cristobal Concho, who settled near here in 1790. They discharged 0.13 lps in 1976.

Five kilometers southwest of Geneva are **McMahan Springs (10)**. They start in the park northeast of McMahan chapel, one of the oldest churches in Texas, established in 1833. They were a very popular gathering place for religious meetings in the past. In 1976, 0.35 lps originated from Weches sand.

**Lobanillo (Little Wolf) Springs (12)** are five kilometers west of Geneva, just west of Lobanillo Creek and north of Highway 21, on property of the Williams heirs. The spelling was probably originally *Lobonillo*. According to Morfi (1781), twenty Hais families lived between Lobanillo Springs and Ayish Bayou (at San Augustine). Just south of the springs is the "Dugout," a severely eroded and entrenched section of the Camino Real. Some springs have been buried beneath sediment from this erosion.

Lobanillo Springs were once on El Lobanillo ranch of Antonio Gil Ybarbo. When Los Adaes mission near Robeline, Louisiana, was ordered to be evacuated by Spain in 1773, many of its residents fell back to El

Lobanillo. From 1820 on there was a wayside inn for travelers here. Many picnics were formerly held at the never-failing springs, according to J. B. Simmons, who guided the writer to them. They are now enclosed in a section of large concrete pipe. They flowed 0.15 lps from Carrizo sand and supplied water to a nearby house in 1976.

Two kilometers north of the Geneva community and 200 meters west of the Myrtle Springs cemetery are **Myrtle Springs (4)**. They were used for baptisms at the church, and as a water supply for a sawmill. The flow from some of the springs (from Sparta sand) was collected for a time in a spring house, now abandoned. A historical marker is located in Geneva. The springs flowed 1.9 lps in 1942 and 1.3 in 1976.

**Liberty Springs (5)**, 10 kilometers north of Milam, are 200 meters southwest of the cemetery of the same name. Producing 0.13 lps on January 9, 1976, and 0.60 on February 17, 1978, from Wilcox sand, they contain much iron. Probably they were a refreshing stop for travelers using the Crow ferry to the east as early as 1797.

Nine kilometers north-northeast of Milam were **Ross Springs (11)**. The water was formerly used by the Ross Springs school. Issuing from Wilcox sand, it contained gas bubbles which would burn. Now the springs are beneath Toledo Bend Reservoir.

Other springs also are now covered by the waters of Toledo Bend Reservoir. Springs formerly existed at many spots along the Sabine River, and were used at the old Crow, Gaines, Low, and Bevil ferry crossings. There was also a salt lick called *La Salenilla* which is now under water, just south of the Crow ferry crossing 12 kilometers northeast of Milam.

**King Springs (6)**, five kilometers east of Milam, were 100 meters north of the cemetery of this name. Being located on the Camino Real, established in 1697, and on the road to the Chabanan-Gaines ferry which operated from 1795 to 1937, the springs were very useful to early travelers. When visited by Deussen in 1914 they were flowing at the rate of 1.3 liters per second. In 1942 the flow was 0.32 lps. Now they are dry. The springs flowed from Carrizo sand on relatively high ground with only a small recharge area.

Fourteen kilometers northeast of Hemphill, in the old Sabinetown community, are **Beddoe Springs (8)**. In 1976 these very attractive springs flowed 0.55 lps from Wilcox sand on top of a ledge of sandstone at an elevation of 45 meters, at the junction of two geologic faults. Some old concrete steps lead down to the springs, part of the flow of which is collected in a 4-

centimeter-diameter pipe. They are 100 meters north of the Sabinetown historical marker. They were the principal water source of the early settlers around 1839. Later many camp meetings were held here.

**Tanyard Springs (7)**, one kilometer east of Beddoe Springs, have a very similar geologic setting, including the intersection of two faults. These fresh-water springs have a delightful location, surrounded by large trees. About 30 meters above the surface of Toledo Bend Reservoir, part of the flow of 0.75 lps in 1976 was collected in a 5-centimeter-diameter pipe. The early residents used the spring water in a leather-tanning factory.

Twenty-four kilometers southeast of Hemphill, at the Hickory Ridge community on Toledo Bend Reservoir (latitude 31°13' and longitude 93°39'), are **Hickory Ridge Springs (9)**. An Hais village once used the waters. The springs flowed 0.65 lps from Catahoula sand in 1976. The water has a slight mineral taste, with much iron precipitate in the outflow.

In the southeast corner of the county, one kilometer southwest of Brookeland, were **Mill Springs (1)**. Their waters were used by the Meigs sawmill, gristmill, and cotton gin, which operated from before 1900 to 1940. The springs are normally inundated by Rayburn Lake. On January 9, 1976, the lake level was below the springs. They were no longer flowing, however, due probably to the many pumping wells in the vicinity. Flowing from the Nash Creek sand, they are reported to have furnished a good flow in former years.

## SAN AUGUSTINE COUNTY

Most of San Augustine County's springs issue from Tertiary Eocene sands, ranging from the Wilcox up through the Yazoo formation. The most productive water-bearing sands, which form the largest springs, are the Wilcox and Carrizo in the northern part of the county. These formations dip to the south at about 20 meters per kilometer. Some springs also run from Quaternary sand and gravel terraces along the major rivers.

Archeological studies in Rayburn Reservoir basin before it was inundated found projectile points and other artifacts which revealed that a prehistoric people lived at the springs at least 9,000 years ago. The earliest explorers found the agricultural Hais people in the same areas. Their population was decimated by disease upon contact with the Europeans. About 1818 the Cherokees, displaced from their homes in the east, replaced the Hais at villages near springs. In 1838 they too were expelled from the area.



Ayish Bayou and most of the other streams were fed by springs. Several mills used the spring waters for power. The creek bottoms were often open glades or swamps. The virgin forest canopy was so dense and intercepted the sunlight so well that there was little or no undergrowth. Clearing the forests and plowing the sandy land did tremendous damage, the scars of which may still be seen. Many springs were buried beneath the man-produced sediment.

Springs are numerous, and only those having some historical or other importance have been included here. Nevertheless water tables have declined because of well pumping, flowing wells, and other causes, and the springs are no longer as large or numerous as they once were. One of the first wells dug, the old town well of 1860, may still be seen in Stripling's drugstore in San Augustine. From 1942 to 1964 the average decline in the water table was 1.9 meters.

The water is usually of a sodium bicarbonate type, soft and acid. It is generally fresh, even including the water from "sulfur" springs. The content of iron, silica, or sulfate may be high.

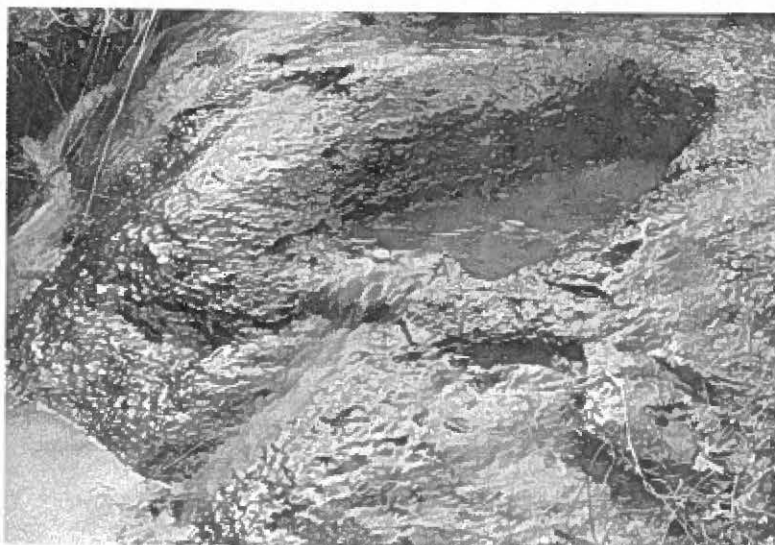
Most of the writer's field studies were made during the period February 14-19, 1978. As this was a rainy time, the observed spring discharges were probably higher than normal for this season.

In 1716 the Spaniard Domingo Ramon established the mission Nuestra Senora de los Dolores among the Hais people, who had a village near present San Augustine. After a short lapse the mission was reestablished in 1721 by the Marquis de San Miguel de Aguayo. In Ximenes' words (1963),

The mission was rebuilt one-fourth of a league beyond the old site; the new site was located beside a creek, close to a spring.

This was in the southwest part of present San Augustine, on a hill just east of Ayish Bayou. The site is

*The bathtub at Greer Springs.*



distinguished by a historical marker. Several springs (5) still flow weakly nearby. In a wood 150 meters north, among many brambles and grapevines, there was a discharge in 1978 of 0.32 liter per second from Weches sandstone and iron ore. This land is owned by the San Augustine Chamber of Commerce. Many travelers on the old *Camino Real* or King's Highway slaked their thirst at these springs.

In a small grove of trees 300 meters south of the mission site, other springs produced 0.17 lps in 1978. According to Knight Parker of San Augustine, these springs were used by the Cartwright tanyard, which stripped the bark from red oak trees in the whole area for use in the tanning process.

Another **Tanyard Springs (9)** are on Harrison Street between Market and Planters Streets in San Augustine. Starting in 1846 Josiah Childers used these waters in a tannery. They discharged 0.75 lps in 1978 from Weches iron-bearing sandstone.

Two kilometers west of San Augustine and just west of the old Greer house, now owned by R. C. Robertson, are **Greer Springs (17)**. In 1978 they produced 0.29 lps of iron-rich and slightly oily water from Weches sandstone. Some 300 meters downstream from the springs, a waterfall has carved a natural bathtub in the rock amid much water pennywort. **Campground Springs**, which flow about one kilometer downstream (southeast) were the site of religious meetings in the 1860s.

Fifteen kilometers west of San Augustine on the south side of Highway 21 is the 1826 Garrett house, owned by Gilbert Garrett and restored by Rayford Stripling. **Garrett Springs (10)**, 300 meters south of the house, produced slightly oily water from several openings in Weches sandstone at 4.6 lps in 1978. Several Indian artifacts have been found here. A pile of stones marks the grave of a man who was shot here, according to Dr. Jim McReynolds of Stephen F. Austin State University. According to Taylor Butler, a nearby resident, tournaments were once held here, consisting of spearing a washer suspended from a pole while riding a horse. The springs are reported never to have failed. Around 1900 gypsies camped at the springs, making rattan wickerware from the vines growing here, which they traded to residents for chickens and other needed items. Palmettos also grow near the springs, and fire ants are invading the adjacent fields.

Two kilometers northwest of Garrett Springs, on Herbert Butler's property, are **Salt Springs (11)**. They were curbed in the 1920s, according to McReynolds, who guided the writer to them. Because of the saline water, coastal swamp grass is found here, along

with several large, 300-year-old mesquite trees, unusual in this area. Only a seep remains from Queen City sandstone.

**Sulphur Springs (12)** are three kilometers west of Garrett Springs, near Attoyac Bayou, on Kerry Whitten's property. They rise from a depression three meters in diameter, accompanied by much hydrogen sulfide gas. In 1978, 0.12 lps of water, black with sulfur, flowed from Reklaw sand. According to Taylor Butler the springs have never failed.

**Butler Springs (13)** are just north of Highway 21 and east of Attoyac Bayou. Flowing from Terrace sand, they provided a popular campground for the Indians. They are enclosed in a curb. They were probably used around 1800 by Juan Guerrero when he established his *La Lunaca* (The Crescent) ranch on an island in the river just to the west. It is said that 14 mule loads of gold were once thrown into one of the crescents or lagoons during an attempted robbery and never recovered.

Ten kilometers north of San Augustine and two north of Bland Lake, springs (1) formerly flowed from Carrizo sand at the roadside. They were much used by travelers. In 1942 they yielded 0.44 lps, but after a shallow well and pump were installed in 1964, they ceased flowing. Now they are buried beneath sand deposits from modern erosion.

**Newton Springs (2)** are eight kilometers north-northeast of San Augustine on Alvin Newton's farm. The water once powered a gin. Newton remembers the water wheel in the 1920s, when it was no longer in use. The water was also used for a sawmill, gristmill, and domestic supply. The millpond, a short distance downstream from the springs where the East Prong of Ayish Bayou crosses Highway 1279, contains numerous cypress trees and is inhabited by nutrias. The springs produced 2.8 lps on May 12, 1942, and 3.2 on February 16, 1978. They issue at an elevation of about 120 meters.

Other small springs (3) flow six kilometers northeast of San Augustine on the north side of Highway 353. Many travelers stopped to drink and fill jugs here in the past. The flow from Reklaw sand was 0.63 lps on May 28, 1942 and "much less in 1964." On February 16, 1978, there was no flow from the old steel drum which formerly encased the springs, but about 0.13 lps from other seeps.

Ten kilometers east of San Augustine and at the roadside just southwest of Black Ankle church are **Black Ankle Springs (4)**. Formerly enclosed in a wooden box, they were popular with the area residents. On May 25, 1942, the discharge was 3.3 lps, and in

1964 there was "little flow." On February 16, 1978, about 0.10 lps trickled from Carrizo sand. The springs, dug out in the road bank, are surrounded by moss and vines bearing red berries.

Two kilometers east-northeast of San Augustine, where Carrizo Creek crosses Highway 353, were **Chumley Springs (18)**, partially on Arnold Kendrick's property. Rayford Stripling, as a boy, often visited the springs, which were popular for picnics. Now Carrizo Creek has changed its course and these springs no longer flow, but the creek is still fed by other springs upstream. The former spring site is thickly covered with vines, briars, and trees.

**Old Brick Springs (6)** are six kilometers east of San Augustine on the south side of Highway 21 opposite the historical monument to the 1831 Elisha Roberts home. In 1834 Amos Parker, on his "trip to the west and Texas," stopped at a double log house here, probably Roberts', and obtained good accommodations. Here he found

as fine a spring of good, clear, soft water, as ever I saw; but it was hardly cold enough for a northern man.

Now owned by Mrs. Eugenia Brooks Seale, Old Brick Springs were an important stop on the old Camino Real and later were used by the Brooks Plantation. Now the site is so overgrown with briars, honeysuckle, and grapevines that in the words of Knight Parker, "a 'possum couldn't get through." Nevertheless the writer did get through the tangle, partly on hands and knees. On February 16, 1978, several springs still poured out 4.4 lps from Weches sand, but the old brick spring box is gone.

**Magnolia Springs (8)** are five kilometers northwest of Bronson, southeast of the Magnolia Springs church and cemetery. In 1978, 0.05 lps issued from Yegua sand and silt. An adjacent well has probably reduced the spring flow. A few small magnolia trees adorn the site.

Eight kilometers west-northwest of Bronson were another **Sulphur Springs (7)**, on the west side of Highway 1751 in the ditch. In 1914, when Deussen noted these springs, the Swannville Post Office was 300 meters west, on land now owned by Herbert Byley. Now there is only a seep from Yegua silt.

Five kilometers southwest of Broadus in the Corps of Engineers' Jackson Hill Park are **Indian Springs (16)**, which feed Indian Creek. On February 15, 1978 they trickled 0.65 lps from Yegua sand, but their flow is said to decrease greatly in summer.

A third **Sulphur Springs (15)** is located three kilometers north-northwest of Broadus in Angelina National Forest. In 1978 they ran 0.08 lps from Yegua sand. Large trees with many woodpeckers surround the springs.

**Bullock Springs (14)** are 22 kilometers southwest of San Augustine on Robert McCroskey's farm, at latitude 31°24' and longitude 94°17'. At the nearby Feliciano crossing of Attoyac Bayou a wild rose bush is said to have been planted over a buried chest of gold. At the springs, according to McCroskey, Zack Moss killed his two teen-age daughters. The springs once furnished water for a sawmill boiler. Flowing from Cook Mountain sand, they are now beneath the upper of two lakes containing large bass.

#### SAN JACINTO COUNTY

The springs of San Jacinto County appear mostly in the hillier north portion. They flow chiefly from Tertiary Miocene sands called the Fleming formation and from Quaternary Willis and river terrace sand and gravel. The Tertiary formations dip toward the southeast at about 10 meters per kilometer. Bogs or baygalls are commonly associated with the springs.

They were vital to early Americans for many thousands of years. Numerous archeological sites now under Lake Livingston revealed that from 390 to 1,410 years ago people were living at springs. The earliest European explorers found the Atakapans, a hunting, gathering, and fishing people, camping near running water. In the early 19th century the Alabamas and Coushattas moved into the area, but were soon displaced by the settlers.

With the clearing of the virgin forests and plowing of the land, tremendous damage was done to the land and groundwater. Man-produced sediment choked channels and springs. Many plants and animals that formerly lived here are gone.

Flowing and pumping wells drew down the water table. Some flowing wells originally had a pressure head of six meters or more above the land surface. Now they have almost stopped flowing. At one well in the Catahoula sand the water level declined 8.9 meters from 1946 to 1965. It is not surprising that many spring and spring-fed stream flows have declined or ceased, even though this is an area of relatively high rainfall. Still, springs are numerous in the county, and only those of some importance are included here.

The spring waters are generally of a sodium bicarbonate type, fresh, soft, and very acid. The content of silica or iron may be moderately high. The fluoride

content is usually less than desirable. Most of the writer's field studies were made during the period March 16-21, 1978.

Many springs pour from Fleming sand in deep actively cutting gullies or ravines around the city of Coldspring. **Cold Springs** proper provided water for the city until 1971, when a well was drilled. There are two groups of Cold Springs. The first group (4) is 0.3 kilometer north of the courthouse on L. C. Dunn's property. Near here the jail, archives building, and other remnants of the old town still stand. These springs were undoubtedly a controlling factor in choosing a location for the settlement. On March 17, 1978, they produced 1.9 liters per second at an elevation of 90 meters.

The second group of Cold Springs (1) is 200 meters east-southeast of the courthouse. The water was formerly pumped from a cypress-lined pit 10 meters deep for city use. Now the pit has filled with sand to within one meter of the top. In a caving gully immediately downstream the springs flowed 0.72 lps in 1978. Trilliums bloom here in April.

In a deep, wooded ravine called the Gully 300 meters southeast of the courthouse are **Gully Springs (3)**. The land surrounding the springs was given to the city by James Sewell for natural science studies by the school students. Many Indian artifacts found here indicate that this was a popular spot in prehistoric times. Trails and an amphitheater have been built among the magnolias. The springs yielded 4.1 lps of slightly oily water on March 18, 1978.

**Harris Springs (2)** are in a similar deep gully 400 meters southeast of the courthouse, on Joe Cochran's land just east of Highway 2973. A sawmill on the old Hogue place here left piles of decomposing sawdust. White egrets frequent the vicinity. The discharge was 6.3 lps on December 17, 1946, and 2.9 on March 20, 1978. As the water table has lowered, the gully is no longer so actively caving.

**Trapp Springs (6)** are 400 meters north-northwest of the courthouse near the L. H. Trapp home. They are relatively small.

**Campground Springs (5)** are 500 meters west-northwest of the courthouse on William Payton's property. They were formerly very popular for camping by travelers, and are still used by some area residents. They trickled 0.12 lps in 1978 from a wooden spring box amid much water pennywort and marsh purslane.

Twelve kilometers northwest of Coldspring on Mrs. Thomas Williamson's property were **Williamson Springs (10)**. The Willow Springs community is now





*Campground Springs.*

in this vicinity. In 1966 the springs yielded 0.063 lps from Fleming sand at an elevation of 98 meters. Now the old concrete spring box is entirely dry.

**Willow Springs (9)** are eight kilometers southeast of Oakhurst on J. E. Street's farm. Projectile points disclose that this was a haunt of prehistoric people. The Willow Springs post office was once here. Willow Springs community has now moved about five kilometers southeast. The water was used in the boilers of a sawmill. A spring box from which the water once poured has now been covered by sand. The iron-bearing water ran from Willis sand and sandstone at 0.14 lps in 1978. According to Street, the springs have never failed to flow. The willow trees, however, are now gone. Small springs also flowed at Raven Hill, four kilometers west, where Sam Houston once lived.

Big Spring Creek south of Pointblank was named for the **Big Springs (11)** which fed it. They were much employed by the early settlers. In 1978 the discharge from thin lenses of Fleming sand was only 0.06 lps two kilometers above the mouth of the creek. The springs are on Southland Paper Company property, leased by Junior Currie.

Ten kilometers north of Oakhurst and two kilometers west of the old Staley community are **Bethea Springs (8)**. C. A. Williams guided the writer to the springs, which are owned by the Waterwood Corporation. According to Williams they have never failed and were formerly much used by area residents. About 0.55 lps emerged from Fleming sand on top of sandstone in 1978. The water appears beneath the roots of a sweet gum and a black gum tree, amid lady ferns and moss. Seven kilometers north-northeast is the similar **Skinner Spring**.

Three kilometers east, on the old Durdin place, are **Durdin Springs (7)**. These springs also have never ceased flowing, according to Williams. They also are on

Waterwood land. They now bypass a section of large concrete pipe from which they once flowed. In 1965 and 1978 the discharge was 0.63 lps, from Fleming sand on top of sandstone. Nearby was a Ceniz (Hasenai) village in early historic times.

**Hale Springs (12)** are just southwest of Camilla, mostly on Doug Hale's farm. C. L. McGowen and Pat Ivory guided the writer to them, in a wood. They were formerly encased in a barrel and used by residents of a wide area. There is evidence of much erosion in the form of partially healed gullies, and the barrel has been buried under sand. The discharge was 0.76 lps on January 11, 1947, and 0.04 on March 21, 1978, from Willis sand. Water pennywort and marsh purslane thrive here.

**Ragsdale Springs (13)** are 200 meters southwest of the intersection of Pine Shadow and Ragsdale Springs Roads in the Ragsdale Springs subdivision. In 1746 Joaquin de Orobio y Bazterra may have paused here. Four kilometers south of Shepherd, Ragsdale Springs subdivision was developed by Morris Creighton. The springs are called **Ragley Springs** on a U. S. Geological Survey topographic map. They flowed 1.0 lps in 1978 in a wooded area, rising at an elevation of 34 meters from Bentley sand on a clay bed. Other springs exist near the Arthur Patterson archeological site three kilometers northeast. Here an Alabama-Coushatta village stood in the 1840s and 1850s.

In Sam Houston National Forest, which covers much of San Jacinto County, there are many small springs. One of the larger groups, pointed out by district ranger John Keck, is a group (14) which are 1.6 kilometers west of Liberty Hill church and fire watchtower and nine kilometers south-southwest of Coldspring. On March 20, 1978, they poured 2.5 lps from clean Willis sand, and are dammed in a pool where a Forest Service road crosses the stream.

**Lewis Springs (17)** are ten kilometers west-southwest of Evergreen in the Old Waverly community on Mrs. H. E. Lewis' property. The springs, which appear high on a hill, formerly supplied water for a store and for cotton gin and sawmill boilers below. The water is still pumped to one house. Dogwood and redbud trees form a beautiful setting in April. On January 11, 1947, the discharge was 3.1 lps and on March 22, 1978, it was 2.3, from Fleming sand and gravel. According to Mrs. Lewis, several other nearby springs have ceased flowing.

Five kilometers west of Evergreen on Mrs. Oliver Ellisor's property are **Ellisor Springs (16)**. Appearing

at an elevation of 69 meters, they feed Chinquapin Creek. In 1914 Deussen said

It would be impossible to mention the number of springs in this vicinity, there are so many.

In 1965, ten families obtained their water from Ellisor Springs. Many still come to the springs for water and to wash cars, according to Mrs. Ellisor. The springs produced 0.53 lps in 1978 through a pipe from Fleming sand, amid much water pennywort and shaded by magnolia trees.

In the Spring Hill community eight kilometers west-southwest of Coldspring were the **Spring Hills Springs (15)**. Resident Jones Eldridge remembers many springs which were much used around 1913. Now there are only a few seeps and pools of standing water in the creek beds.

## SAN PATRICIO COUNTY

There is little topographic relief in San Patricio County, the highest point being only about 60 meters above sea level. For this reason, and also because most of the county is underlain by impervious clays, springs have not had much opportunity to form. The exceptions include sandy terraces along the Nueces, sands along Chiltipin Creek, and barrier beach deposits along the coast, where springs and seeps may still be found.

Archeological studies leave little doubt that Paleo-Indians inhabited this area, especially near springs and spring-fed streams, for many thousands of years. But because of the great changes in the landscape constantly wrought by hurricanes and other natural forces, little evidence of these people, or of the springs which they used, remains.

The shallow lakes which may be found among the dunes of barrier beach deposits contain water that is only slightly saline. These lakes are fed in part by seeps emerging from the lower slopes of sand dunes. The Kopano Indians and their predecessors knew that they could always find potable fresh or slightly saline water in these areas by digging a hole a meter or less in depth. Perhaps Alonso Alvarez de Pineda, when he mapped and named Corpus Christi Bay in 1519, sent his men ashore to fill water casks from the springs on its shore.

Many plants and animals depend for their existence upon the springs and seep-fed lakes. Herds of bison, antelope, and wild mustangs and cattle once roamed the area. Now the predominant animals include coyotes, black-tailed jackrabbits, rattlesnakes, herons,

egrets, marsh hawks, and in the winter thousands of ducks and geese.

Groundwater tables have declined, largely because of heavy irrigation pumping. A number of flowing wells formerly existed, but nearly all have now ceased flowing. In addition, the water has been contaminated to some extent by sea-water intrusion and improper disposal of oil-field brines.

The remaining spring waters are generally of a sodium chloride type, slightly saline, hard, and alkaline. The silica and iron content may be high.

The writer visited the county's springs chiefly during the period January 16-21, 1977. Above-normal rainfall had taken place for four months previously. The spring-flow discharges observed are therefore believed to be higher than normal for this season.

Springs reportedly were once numerous along Chiltipin Creek in the northern part of the county. This is not surprising, as many Indian bands formerly made their homes along the creek. Now the springs have nearly all disappeared, probably because of irrigation pumping in the recharge area to the northwest. Even in a very wet period, the writer could find only some seeps (3) from fine sand along Chiltipin Creek just east of the Highway 181 bridge at Sinton. The figures in the table of Selected Chemical Analyses, of water from a nearby shallow well, show it to be slightly saline, with a dissolved-solids content of 1,480 milligrams per liter. The well's water level was 6 meters below the surface in 1965, a little below the elevation of the seeps.

As might be expected, springs have been found at several archeological sites. The McGloin Bluff site is at the southern tip of Live Oak Peninsula, at latitude 27°49' and longitude 97°12'. Corbin (1963) described the springs here (4) as follows:

There are two running springs located on the site. One is on the western extremity of the site and only started flowing freely after the recent (1961) hurricane Carla. A second and more reliable spring is located at the mid-point of the bluff, and the major portion of the site seems to be centered in this area. There used to be a third spring on the eastern edge of the site, but apparently it has not been flowing for the past 20 years.

When the writer visited the site on January 20, 1977, after much rainfall, the central spring was flowing 1.8 liters per second, with about 20 smaller springs and seeps bringing the total to 4.9 lps.

Projectile points, scrapers, shell artifacts, and potsherds indicate that an early people lived at these springs at various times during the past 2,000 years. The springs issue from sand at the base of the bluff

## SCURRY COUNTY

about one meter above sea level in a small marsh of cattails, grasses, and vines, and then flow onto the beach. The water is fresh, but contains much iron. The recharge comes from the many ponds among the live-oak-covered sand dunes on Live Oak Peninsula to the north.

Ingleside Cove, three kilometers west, is another spot which was favored by early Americans. Here (5) a flow of 1.3 lps of iron-bearing water was emerging from sand and shell deposits in a small park on January 20, 1977.

About 1.5 kilometers north of the Ingleside Cove site, southeast of the mouth of Kinney Bayou, is the Windy Hill site. Seeps (6) of about 0.10 lps issued from sand and shell deposits in 1977. Pedernales dart points found here point to occupation of this site by people of the Archaic Stage as long as 6,000 years ago. Many other archeological sites and associated springs have been found on Kinney Bayou.

Five kilometers south of Gregory are many small springs (7) along the bay shore. Here, at the Brown archeological sites, people lived perhaps 5,000 years ago, leaving shell middens, Tortugas projectile points, and various stone tools. The springs have been much disturbed by ore stock piles and industrial operations.

The most colorful springs in the county historically are **Round Lake Springs (1)**, located north of San Patricio at latitude 27°58' and longitude 97°46'. In this area, settled around 1750, early residents used the springs in the years before they were in a position to dig wells. A celebration is held annually in San Patricio on the weekend nearest Saint Patrick's Day. Round Lake is an old ox-bow lake or former river channel, on whose banks stands the 1855 McGloin house. The springs flowed from a sand and gravel river terrace, at the rate of 0.35 liter per second on January 19, 1977. According to nearby residents they now flow only during wet periods. Gravel pits are located nearby on the terrace.

## SCURRY COUNTY

In the days when Clovis and Folsom men and women roamed the area some 10,000 to 15,000 years ago, and up until 100 years ago, springs were strong and numerous in Scurry County. The accompanying game, grass, and wood were also abundant.

As early as 1885, when well pumping began, it was noted that the water table along the creeks was beginning to sink. Now the springs are failing fast, due primarily to heavy irrigation pumping. Many of the more important springs have dried up completely. The rest are not expected to last long. Camp Springs, for



*Springs at Ingleside Cove (foreground)*

example, once flowed at over 400 times its December, 1975, rate.

Scurry County's springs flow chiefly from Tertiary Ogallala sands and gravels, Pleistocene (Quaternary) sand, and Triassic Dockum (Santa Rosa) sandstone. The water is of high quality, being of a calcium bicarbonate type, and is generally fresh, very hard, and alkaline. The writer's field studies for the most part were done on December 12-17, 1975.

**Mooar Springs (8)** are 11 kilometers south of Fluvanna on Gilbert Merritt's ranch. Burned-rock middens indicate that this was a haunt of prehistoric people. According to Merritt, the springs flowed constantly until the 1940s. On June 1, 1979, there was only a pool fed by seepage from Ogallala sand on Triassic sandstone. In winter when there is little vegetation, the water is reported to run about 100 meters down Mooar Creek and across Highway 1269. Seep willows and a few large mesquite trees fringe the pool, occupied by many birds. A shallow well pumps nearby.

**Deep Creek Springs (4)**, which formerly fed Deep Creek running through Snyder, consisted of a large number of small springs extending from Fluvanna to Dermott in northwestern Scurry County, centering around latitude 32°50' and longitude 101°05'. Pete Snyder's store on Deep Creek, established in 1878, was the beginning of Snyder. In the vicinity of these springs in 1876 a rare albino bison was killed. As Holden and others (1972) describe it,

Deep Creek was fed by springs when the first settlers arrived in the area, and was a running stream for many years after that. A story in the Scurry County News for April 25, 1895, reported that "Deep Creek is giving up its fine fishes to the tables of our generous citizens" and that the Rev. J. M. Wood, Harry Nelson, and Price Higgins had reported a catch of about 80 pounds on the previous Saturday. The creek was used for picnics and all kinds of outings, and when O. P. Wolf developed a park along its banks the townspeople really had a special place for gatherings.



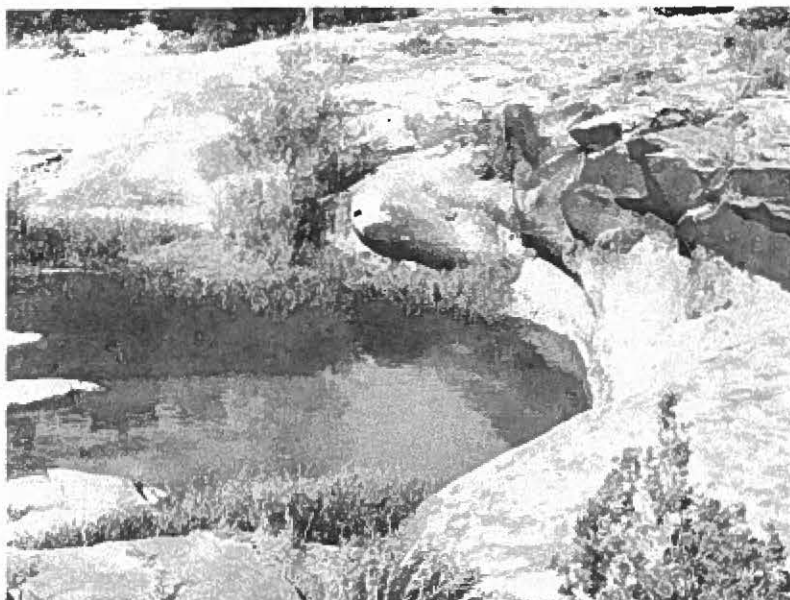
In the northwest corner of the county, just east of Highway 1269 where it crosses the Garza County line, are some very small springs (9) on Bob Jordon's ranch. They issue from Triassic sandstone near the base of a high bluff. They were much used in the past by travelers. They are now usually only seeps dripping from the rock, but in winter the water is reported to run 50 meters before disappearing. Small live oak and cedar trees thrive here.

**Dripping Springs (3)** are 21 kilometers east-northeast of Snyder and four northwest of the Camp Springs community on the Charles Harrell ranch. Flowing 0.70 liter per second on December 15, 1975, from Dockum sandstone, the water is slightly saline to the taste. A short distance downstream it falls over a semi-circular ledge of sandstone, with draperies of ferns, into a pool. This delightful spot was used by prehistoric men, as evidenced by bedrock mortars close by. These and several other springs have maintained Rough Creek as a flowing stream.

**Camp Springs (2)** are one kilometer northwest of the historical marker in the Camp Springs community, also on the Harrell ranch. Amid willow and hackberry trees, they seep from the massive Triassic Camp Springs conglomerate into a pool about 15 meters in diameter, at an elevation of 680 meters above sea level. Numerous artifacts, metates, bedrock mortar holes, and pictographs in a nearby cave indicate that the springs were used by prehistoric people over a long period of time. (See Plate 12, e).

In 1876, the Nunn brothers, driving the first cattle herd in Scurry County, reached Camp Springs, which

*Camp Springs.*



were then called **Sand Rock Springs**. In 1878 W. H. Camp built a dugout at the springs. Their popularity in the 1880s is described by Holden and others as follows:

The Berrys, who lived in Fisher County, would load dirty clothes, wash pot, and tubs in the wagon and drive about 10 miles to reach their laundering place. There they built a fire under the pot on a grassy slope and did the washing by the spring. While the clothes dried on branches of trees, they spread their noon dinner and ate. At last they gathered the clothes, filled barrels with fresh water, and drove the long, rough way home.

In 1881 a band of Comanches stole some horses from Camp Springs. The pool at the springs was used for many baptisms. They became a community center, watering place, site of the Camp Springs schoolhouse, and the scene of many picnics and meetings. It was natural that a town should develop, and in 1900 the Camp Springs post office was established. But both the town and the springs are now dying. On April 8, 1924, the discharge was 57 lps, in 1946 it was 2.8, and on June 14, 1975, it was only 0.13 lps.

**Greene Springs (1)** are 18 kilometers east of Snyder and three southwest of their historical marker on Highway 180. They are on the property of Jimmy Beck and Judge Preston Wilson. Issuing from gravel at the base of the Ogallala formation on top of massive Dockum sandstone, they are considered by some to be the source of the Clear Fork of the Brazos River.

The Scurry Chapter of the South Plains Archeological Society has found many ancient artifacts at Greene Springs, including Clovis and Folsom projectile points, indicating usage of the springs by early Americans many thousands of years ago. In the sandstone outcrop can be seen metates or bed-rock mortars which were used by these people to grind maize and hackberries. Indian occupants of the site carved pictures or petroglyphs in the rock. Steps were also carved in the soft-rock ledges for easier access. Nearby are six channels in the sloping rock bluff, up to 30 centimeters wide and 10 deep. These may have been worn by prehistoric children sliding down the bluff on pieces of stone or wood when there was a much greater flow than at present. Curtis Tunnell, Texas state archeologist, has found similar slides in rock in Val Verde County, and believes they were formed by children at play. In more recent times, numerous names and dates have been carved in the cliffs and caves. (See Plate 6, c).

In 1849 Captain R. B. Marcy, and later Lt. Col. Robert E. Lee, camped at Greene Springs. About 1880, stock rancher J. I. Greene moved to the springs

with his family, living in half-dugouts. Later the springs became a favorite picnic spot. Discharge records in lps are:

Dec. 20, 1943	2.8	Oct. 5, 1978	0.13
Jun. 14, 1975	0.13		

Raccoon tracks are numerous in the sand among the cattails and sunflowers. Willow, cottonwood, hackberry, and chinaberry trees shade the site. Severe gully erosion has filled the downstream channel with sand.

**Dunn Springs (7)** are a large group of small springs four to eight kilometers northeast of Dunn. Their waters collected behind a natural rock dam on Sulphur Creek at Dunn, which was a favorite haunt for Indians. As described by Holden and others, early travelers made good use of the springs:

At the end of a good day's journey from Colorado City toward Snyder was a pool of cool, clear water, dammed up by a natural rock outcropping. Here the freighters watered their teams and made camp for the night. Families soon came to take up land on each side of the water in Big Sulphur and Deep Creek. The year 1890 found enough people living around these water sources to apply for a post office. The request was granted, and the community was given the name Dunn after the A. T. Dunn family who tended the mail.

Dunn Springs pool was much used for baptizing, swimming, and fishing. It also furnished water for the school in the early settlement years. Before 1896, a windmill well and watering trough were installed. The springs still flowed at a combined rate of 1.7 lps on December 16, 1975.

Springs (6) were located five kilometers southwest of Ira, on the present M. D. Cary ranch. Pictographs in caves south of here along the Colorado River indicate that the area was frequented by early Americans. This is believed to be another spot where Captain R. B. Marcy, that prolific and lucid writer, camped in 1849. Neighbors later hauled water from the springs for many kilometers. They have not flowed since about 1945. A well located close to them probably contributed to their demise.

**Knapp Springs (5)** are located two kilometers southwest of the old Knapp post office, which is 23 kilometers southwest of Snyder. The post office, now abandoned, was called Bison in 1888. The springs flow from Quaternary terrace gravel on the abandoned C. W. Addison farm. The largest, flowing 0.72 liter per second on December 15, 1975, is at the homestead. A smaller one, flowing 0.24 lps, is in the abandoned road about 500 meters east. Several others are in the vicinity. The springs are reported to have been much

stronger 35 years ago and more, when residents hauled water from them for distances up to seven kilometers. Much oil-well drilling in the vicinity has probably damaged the quantity and quality of spring water.

## SHELBY COUNTY

Nearly all of the springs in Shelby County flow from Eocene sands of the Carrizo and Wilcox formations. The largest are those issuing from Carrizo sand in the southwestern part of the county. There is some evidence that spring flows have decreased since the days when the Hasinai made their homes by them. This is especially true in areas where heavy pumping has drawn down water tables.

Most of the writer's field studies were made on January 26-31, 1976.

Some formerly well-known springs have been inundated by the waters of Toledo Bend Reservoir. An example is **Beck Springs**, which were located at Myrick Ferry over the Sabine River, as described by Deussen in 1914.

The county's spring waters are generally fresh, soft, and acid, being primarily of the sodium bicarbonate type. The content of iron, magnesium, manganese, or sulfate may be high, especially in the waters of "mineral" springs.

**Center Springs (5)** formerly flowed copiously at the American Legion Hall near the intersection of San Augustine and Martin Streets in Center. They were relied upon greatly for water by the early residents in the 1840s. Since a high-capacity well was installed at the springs, they have been reduced to a seep. A heavy precipitate of iron oxide occurs at the site.

**Todd Springs (2)** are four kilometers west-southwest of Timpson and 200 meters north of the Todd Springs church. Popular for gatherings in the past, they trickled 0.25 lps from Wilcox sand in 1976.

**Timpson Springs (1)**, in Soso Park in Timpson, flow from Wilcox sands. An Anadarko village was located near here in prehistoric times. In 1828 General Manuel Mier y Teran may have paused at the springs. They were much used by early settlers in the 1860s. They were described as mineral springs flowing 0.95 lps by Deussen in 1914. In 1976, the flow was 0.85 lps.

**Hilliard Spring (12)** is five kilometers south-southeast of Tenaha, on Mrs. Elbert Bush's property. In the early 1840s, C. T. Hilliard and his wife built their cabin here. In 1844, the Regulators were attacked by the Moderators at the springs in a fight over spurious land grants. According to Clinton Childs, who guided the writer to the springs, those killed in the battle, and



Hilliard Springs.

the Hilliards, were buried on a hill one kilometer south-southwest of the springs. The old circular curb which enclosed the springs may still be seen. In 1976, the flow of 0.06 lps, from Wilcox sand, started about 100 meters downstream. The site is in second-growth woods which were once cultivated, according to Childs.

**Doggett Springs (10)** are in the community of that name, three kilometers south of Joaquin. Much used by early residents in the 1860s, they issue from Wilcox sand, flowing 0.65 lps in 1976. As they are directly on Highway 7, they are still very popular with motorists, who stop here to drink and fill water jugs. As a well has now been installed here, the future of these springs is not bright.

**National Forest Springs (9)** are in the Sabine National Forest about 11 kilometers east of Shelbyville and just south of Boles Field campground, at latitude  $31^{\circ}46'$  and longitude  $93^{\circ}58'$ . Flowing from soft Wilcox sandstone, they discharged 0.32 lps in 1937 and 1976.

Ten kilometers east of Shelbyville and 200 meters north of the Holly Springs cemetery are **Holly Springs (8)**. The old Holly Springs community, which no longer exists, grew up around these springs. They flowed 0.75 lps from Wilcox sand in 1976.

One kilometer northeast of Patroon are **Indian Springs (7)**, the source of Indian Creek. Flowing from Wilcox sand, they were much used by the Hasinai as well as by early settlers in the 1840s. They reportedly flowed more strongly in the past than the 0.48 lps in 1976.

A second **Todd Springs (6)** is six kilometers south-southeast of Shelbyville in the Todd Springs community. discharging 0.55 lps in 1976 from Wilcox sand, these springs are known for the laughing ghost which is reportedly heard on dark nights. The ghost is supposed to be that of Mrs. Todd, who was killed by Indians here. Early campers made much use of the springs. The

church also formerly used their water.

Eleven kilometers south of Center, among high hills of Carrizo sandstone (latitude  $31^{\circ}42'$  and longitude  $94^{\circ}12'$ ), are **Hughes Springs (4)**. Now on Kelly Robbins' place, their flow has declined in recent years. In 1937 they discharged 0.32 lps, and in 1976 just 0.15 lps.

**Bailey Springs (3)** are the largest and most important in the county. Located 12 kilometers southwest of Center, they flow from the Carrizo sand into Bailey Lake. They emerge at an elevation of 185 meters. They formerly powered a gristmill upstream from Bailey Lake. The ditch which carried the water to the mill may still be seen. These springs together with others downstream now supply all of the water needed by the 5,000 residents of Center. The discharge measurement of 39 liters per second was made at the old mill dam above Bailey Lake on January 27, 1976.

Four kilometers northeast of Martinsville in the Grigsby Community are **Grigsby Springs (11)**. Members of the Lower Nasoni tribe formerly lived at these springs. They flowed 2.0 lps from the base of high hills of Carrizo sandstone in January, 1976.

## SHERMAN COUNTY

Although springs no longer exist in Sherman County, many formerly poured from Ogallala sand and caliche, especially along the major streams. There is no doubt that they were used for many millenia by early Americans, who left stone projectile points, knives, metates, and manos at these sites.

Groundwater levels have declined severely, chiefly because of the enormous increase in pumping for crop irrigation in recent years. For example, from 1965 to 1970 the water table declined as much as 13 meters. This is the prime cause of the failure of all springs in the county. In addition many windmill wells are having to be deepened or abandoned.

As the water table falls, the more desirable grasses can no longer obtain enough water and are dying out, to be replaced by desert plants such as yucca. Many animals such as bison, wild mustangs (brought by the Spaniards), antelope, deer, and wolves formerly depended upon the springs for water and food. With the disappearance of the springs and the loss of their natural habitat, many of them can no longer survive in the county.

The spring waters were of a calcium bicarbonate type, usually fresh, very hard, and alkaline. The fluoride content was often high. The writer's field studies were



made chiefly during the rainy period of May 23-28, 1977.

According to Stratford historian Selma Pendleton, Judge J. D. Rawlings moved west about 1900 to some springs (2) seven kilometers west of Stratford. These springs, called **Rawlings Springs**, were on Mrs. Joe Billington's ranch. According to John Knight of Stratford, Coldwater Creek has not run at Stratford since 1927, except for storm runoff. Probably Rawlings Springs failed at about this time. Now reddish-violet wine cups brighten a field at the erstwhile springs, shaded by hackberry and dying elm trees.

Probably there were a number of springs in former times along the Beaver or North Canadian River in Texas. Many still discharge along the river in Oklahoma, both upstream and downstream from the short Texas reach. Several likely spots for former springs were observed by the writer on the Beaver River in Texas, but no one now living can remember them. The name Beaver of course implies a running stream at one time.

John Knight, of Stratford, recalls running water on Frisco Creek in Oklahoma just below the state line in 1913. On this creek also, the indications are that small springs existed at one time in Texas.

In the early 1870s, J. D. Rawlings built a cabin at **Coldwater Springs (1)**, which still stands at the Bivins ranch headquarters in eastern Sherman County at latitude 36°15' and longitude 101°44'. Other springs were located in the vicinity, especially four kilometers downstream. Many other settlers were attracted to the springs before 1895. Rawlings told Earl Smith, who still lives in Stratford, that Coldwater Creek flowed through most of its length in the 1880s and contained many fish. By 1906, when Smith and Marvin Harrison of Stratford arrived, the flow was somewhat diminished. According to Bivins ranch manager John Bearden, Coldwater Springs have not flowed since about 1967. Until then the downstream springs emerged from a hole 50 meters in diameter and about 20 meters deep. Large groves of cottonwood and other trees still stand at the former spring sites.

On North Palo Duro (Hard Wood) Creek in the southeastern corner of the county, one kilometer east of Highway 1060, were **Lanners Springs (3)**. Perhaps Pedro Vial stopped at these springs in 1793 on his return trip from St. Louis to Santa Fe. In 1892, John Lanners built a stone, half-dugout house here which still stands. John Knight recalls running water in this area, and a site adjacent to the dugout appears very favorable for former springs. Now the site is marked by a copse of cottonwoods, elms, locusts, and hackberries.



*Half-dugout home at Lanners Springs.*

Rabbits and rattlesnakes make their home here. A windmill close by probably contributed to the drying up of the springs. Marvin Harrison states that in 1906 there were also small springs farther up North Palo Duro creek, at the Highway 287 crossing.

## SMITH COUNTY

Most of Smith County's springs flow from Tertiary Eocene sand, sandstone, and iron ore. These formations include the Carrizo, Reklaw, Queen City, Weches, and Sparta. They dip as much as 30 meters per kilometer toward the East Texas embayment, which passes through the center of the county. Salt domes and faults influence the location and quality of spring waters. As most of these formations have a relatively low permeability, water must move slowly through them. Some springs also issue from Quaternary river terrace sand and gravel. The combination of many sand aquifers and a hilly topography has produced an abundance of springs in the county.

For thousands of years ancient people used the spring waters. From about 800 to 1300 A.D., an agricultural, highly advanced, mound-building people lived near the springs. At the dawn of history in the area, the Caddoes were found here. Beginning about 1819, the Cherokees and other tribes which had been expelled from the Southeast shared the springs with the Caddoes. In 1839, in one of the darkest chapters in Texas history, the Indians were largely massacred by the combined Texas armies. The survivors sought refuge in more friendly Oklahoma, and the land sharks moved in to seize the Indian lands.

The springs vegetation usually includes ferns, mosses, and cattails; dogwood, redbud, willow, sweetgum, maple, sycamore, birch, sumac, and ash trees; and plum thickets. Many trees, such as maple,

ash, sumac, and black gum, turn crimson in fall. In spring the blossoms of dogwood and redbud open. Briars which have sprung up in second-growth woods are a curse of the area.

Many animals which once frequented the springs are now gone. Passenger pigeons, which were clubbed to death in their roosts, are extinct. Today there is little animal life in the spring waters. Perhaps the torrential floods caused by man's activities wash aquatic life-forms away before they can gain a foothold. But springs feed many artificial lakes which are well stocked with fish.

Although springs are numerous, many have been dried up by well pumping and other activities. In the Tyler area, for example, the water level in the Carrizo aquifer declined as much as 16 meters between 1934 and 1962. Flowing wells are also allowed to waste much groundwater.

In addition, clearing and plowing of steep hillsides has caused severe sheet and gully erosion in the past. The sediment has filled many channels and covered springs.

The spring waters are usually of a sodium bicarbonate type: fresh, soft, and acid. The fluoride content is usually low. Iron content is high or very high.

Most of the writer's field studies were made during the period October 28–November 2, 1979. A rain of around four centimeters on October 30 increased spring flows in the following period to above-normal discharges for this season.

According to Woldert, there were in 1855, ten times as many springs around Tyler as in 1948. They were, of course, a major reason for locating Tyler where it is. There were springs of "gushing freestone water on either side of the courthouse" which were much used by early residents.

One of the **Tyler Springs (5)** was near the intersection of Elm Street and Spring Avenue. Here Berryman Walker killed two turkeys in early settlement days. The spring was walled up with brick and made into a public watering place which was also used for baptisms. The spot is now covered and in a storm sewer. The spring water emerges briefly one block east, however, at Fannin Avenue and Elm Street. On July 6, 1936, 0.63 liter per second flowed from Sparta sand here. On October 30, 1970, the discharge was 1.7 lps.

The springs on the other side of the courthouse still emerge near Bois d'Arc Avenue and Oakwood Street. They are also largely enclosed in storm sewers now. On October 30, 1979, the discharge was 0.75 lps, some of which appeared to be waste water.

The **Arms Factory Spring (4)** was just west of the

historical marker at Robertson Avenue and Mockingbird Lane in Tyler. When first discovered by white men it was a bold spring, one of the largest in the area. Now there are only seeps of iron-bearing, fresh water here. But downstream at Bois d'Arc Avenue and Lindsey Lane there was a flow of 0.20 lps from Sparta sand on October 30, 1979. Farther downstream, at Broadway and Dobbs Streets, the discharge increased to 0.70 lps. Redbud trees and kudzu vines fringe the channel.

**Neff Springs (3)** were near the intersection of Glenwood Boulevard and Houston Street in Tyler. They formerly fed Will Neff's swimming pool. In 1947 they were walled up and producing a "moderately large" flow. Now a synagogue stands where the swimming pool and springs were located. The springs are dry here. But one block south, at Glenwood Boulevard and Grove Street, water still seeped from Sparta sand on October 30, 1979.

At the northeast corner of the Tyler airport are **Beard Springs (12)**, on Richard Beard's ranch. One group, just behind the Pleasant Retreat church, was formerly used by the church. When the springs were contaminated by a nearby school sewer, the church stopped using them, according to Beard.

A second group of Beard Springs, on the north side of Highway 64, was walled up by the WPA in the 1930s. They were much used as a campground by travelers in early days. A hydraulic ram once pumped the water to Beard's grandfather's house. The water from Beard Springs trickles from Sparta and Weches sands, feeding a small lake. Heavy rains on October 30, 1979, prevented estimating the flow, but it is reported normally to fill a 2-inch (5-centimeter) pipe.

**Galena Springs (15)** were in the southwest corner of the Galena community, six kilometers southwest of Garden Valley, on Winnie Smith's property. According to long-time resident J. M. Gilley, many early residents obtained water from these springs. A second group of springs, under a sweetgum tree, was used for washing clothes. On October 31, 1979, there were only seeps from Queen City sand. Common reeds and a few plum bushes surround the site.

Six kilometers southwest of Mineola are **Burleson Springs (17)**, on George Pirtle's property. They are on the west side of Burleson Lake and east of a historical marker. Here the Texas troops were disbanded after driving the friendly Cherokee Indians from the republic. The springs were dug out to collect more water, and are now only a seep from Queen City sand.

**Walnut Springs (16)** are four kilometers west of Lindale. Here John and Mary Scarborough settled near a "very fine spring." The Walnut Springs church stood

200 meters south. An Indian campsite was located at the springs, where the writer found a broken metate. A 1960 topographic map showed the springs to be active. But on October 31, 1979, there was only a seep from Weches sand. Unfortunately the springs have been used as a dump ground.

**Wood Springs (9)** are five kilometers south of Lindale on Roy Smith's ranch. They are adjacent to Prairie Creek just east of two former churches and a school in the Wood Springs community. Many very small springs trickle from Weches sand.

**Myrtle Springs (18)** are three kilometers northeast of Lindale. Mary Lee Herrera lives in the old Myrtle Springs church just northeast. The springs feed American Legion Lake. On October 31, 1979, the discharge at the road crossing one kilometer downstream (east) from the springs was 25 lps, mostly surface runoff from rains the preceding day. Minnows dart in the water, which flows from faulted Weches sand.

**Spring Lake Springs (19)** are mostly beneath the surface of Spring Lake, nine kilometers north of Tyler. On October 31, 1979, 36 lps, from Queen City sand, was passing the lake outlet works. In a swamp below the dam is a large colony of ferns, including royal ferns. Cottonmouth snakes may be found here.

**Beauchamp Springs (20)** are near the entrance office in Tyler State Park, 14 kilometers north of Tyler. The water pours from faulted Weches sandstone amid many boulders of sandstone and iron ore. A footbridge crosses the creek just below the springs. On October 31, 1979, 1.1 lps of iron-bearing water emerged, running 300 meters but not reaching the 26-hectare park lake.

Other springs flow in Tyler Park Lake, causing a discharge over the spillway of 3.4 lps on October 31, 1979. The lake is stocked with channel catfish, black bass, and sunfish. Deer, foxes, squirrels, raccoons, opossums, ducks, and geese frequent the springs and lake.

**Red Springs (21)** are 13 kilometers east of Lindale and just west of the Red Springs community on Mrs. Ernest Kelly's property. According to long-time resident Brittain Balfour, many early travelers on the old Dallas-Shreveport road stopped to camp here. There are two groups of iron-bearing, freshwater springs. On October 31, 1979, those on the south produced 0.65 lps and those on the north 0.10 lps. These and other springs feed four ponds downstream.

From the 1850s to the 1870s the ghost town of Belzora, four kilometers south of Hawkins on W. B. Duckett's ranch, was the head of navigation on the Sabine River. Several springs here were doubtless used

by the old river port's residents and travelers. Some of the **Belzora Springs (24)** still flow just east of the bridge, 500 meters east of the historical marker, at a fishing boat launching ramp. On November 1, 1979, 0.13 lps trickled from faulted Sparta sand.

**Linn Springs (23)** are six kilometers northwest of Winona on Mrs. Virgie Johnson's property. Connie Hackett, an old resident, carried water from the springs to Linn Springs school, 300 meters west-northwest, in 1919. On November 1, 1979, 0.10 lps trickled from Sparta sand. Ebony spleenwort ferns and moss-covered banks surround the springs, beneath sweetgum trees.

Six kilometers southwest of Winona and 200 meters west-northwest of Harris Creek church are **Harris Springs (22)**. On November 1, 1979, 2.5 lps issued from Weches sand on sandstone, producing several waterfalls over sandstone ledges. American Beauty-berry shrubs, ferns and mosses adorn the site. A few kilometers west, other springs feed the old Driskill natatorium or swimming lake, now on James Riddle's ranch.

**Camp Ford and Pine Springs (6)** are seven kilometers north-northeast of Tyler in the Pine Springs community on Harris Fender's property. During the Civil War up to 6,000 prisoners of war in Camp Ford obtained their water from these "large springs," which fed a cool, clear stream flowing through the prison grounds. The water was described as "impregnated with iron and sulphur" and "a perpetual tonic." Several wooden reservoirs were used to collect the water.

According to Nell Burns Dittmer, Camp Ford Springs formerly fed the Burns natatorium or swimming lake. The lake has now been filled. On October 30, 1979, the discharge of iron-bearing water from Sparta sand was 0.08 lps, a far cry from the abundant flow of early days. Several wells pump the groundwater nearby. Frogs hop among the sensitive ferns and cat-tails, shaded by large pine trees. A historical marker regarding Camp Ford and the springs is in a rest area 200 meters northeast of the springs.

**Cousins Springs (7)** are seven kilometers northeast of Tyler on land owned by the Ability Real Estate and Investment Company. They were described as among the finest springs in the area when W. H. Cousins settled here in 1845. When the railroad came through, a stop was made by the first train for lunch at these springs, according to Ashley Beasley, former owner. Surrounded by a rock wall, the springs have been much used for meetings and 4th-of-July picnics. The old Tyler-Gladewater road passed the site.

Cousins Springs flow from Sparta and Weches sand



on the south side and close to Ray Creek. On October 30, 1979, 1.3 lps gushed up through large sand boils. The water is very high in iron content, containing 8.7 milligrams per liter. It also contains 800 coliform organisms per milliliter and 0.11 milligram of manganese per liter. Sensitive ferns and poison ivy surround the pool, shaded by ironwood and birch trees.

The discharge of spring-fed Ray Creek just above Cousins Springs was 23 lps on the same date. Much sandstone and iron ore crop out in the surrounding hills.

Two kilometers south of Winona are **Campground Springs (27)** on the land of Owen Development Company. According to Andrew Dozier, who has lived in the Winona area since 1887, Campground Springs were called **Lott Springs** in early days. Religious services were held in a brush arbor, and in 1849 the first Harris Creek church was built of logs here. An old cemetery is nearby. On November 1, 1979, 0.13 lps seeped from Weches sand.

**Gum Springs (25)** are three kilometers south-southeast of Winona on Victor Kay's ranch. They were at a crossroads of Indian trails in prehistoric times. They were depicted on J. de Cordova's 1856 *Map of the state of Texas* and Johnson's and Ward's 1863 *New map of the state of Texas*. A post office was located here from 1849 until 1857, when it was moved to Starrville.

The several Gum Springs pour from Queen City sand in a wooded ravine. On November 1, 1979, the discharge of iron-bearing water was 1.0 lps. The water ran 300 meters, disappearing into sand before reaching Harris Creek. Water striders dart on the fern-fringed pools in the shade of sweetgum and other big trees.

**Baker Springs (26)** are eight kilometers east of Winona on Delia Shankman's ranch. Their water was once used by Baker Springs school across the road to the north. The school was later moved one kilometer west. On November 1, 1979, 0.55 lps seeped from Queen City sand. Holly trees grow among the pine slash here.

**Lincoln Springs (1)** are in the northeast corner of the county, eight kilometers southwest of Gladewater, on the Laird farm. They are one kilometer southwest of the Lincoln Springs church, close to where the church was formerly located. The very small springs trickle from Queen City sand. Several other springs flow in the vicinity.

Five kilometers east of Arp are **Cool Springs (28)**. Cool Springs church was formerly located near the springs on Wright Branch. Later the church was moved two kilometers south, near other springs on Wright Branch, on George Wilson's ranch. Cool and other

springs from Reklaw sand maintain the flow of the branch. On November 1, 1979, the discharge at Highway 64 was 6.8 lps.

**Headache Springs (11)** are six kilometers east-southeast of Tyler, 400 meters north of their historical markers on Highway 64 and just north of Universe church. They were well known for their healing mineral waters. During the Civil War a medical laboratory here made medicines and whiskey for the government. The medicines were made from the mineral water and herbs such as poke root, snakeroot, mullein, jimson weed, Jerusalem oak, nightshade, mistletoe, and cherry bark. On November 2, 1979, 0.35 lps poured from Weches sand in a mixed hardwood and pine forest.

**Bascom Springs (29)** are eight kilometers north-northeast of Whitehouse on the property of the White Oak Water Company, about one kilometer south of Bascom Methodist church. An Indian village and a north-south trail were located here. On November 2, 1979, 3.6 lps gushed from Weches sand and iron ore. Partially healed gullies in the woods indicate that the surrounding land was once cleared and plowed. As a result much of the channel has been filled with sand.

About two kilometers west of Bascom Springs was the 1846 McAdams gristmill. It used the spring-fed waters of Gilley Creek for power.

**Stripling Springs (31)** are two kilometers northwest of Bullard on H. H. Stripling's ranch. Four springs issue from Weches sand here. The missionary Jose de Calahorra y Saenz may have stopped here in 1761 on his journey to present Rains County. One of the springs was formerly used by the Cotton Belt Railroad, one is used by Stripling for yard water, and the others provide stock water. On September 15, 1936, the flow was 0.63 lps from Weches sand. On November 2, 1979, it was 1.6 lps, flowing through a patch of giant cane. The city of Bullard has a shallow, 3-meter-deep well here. A park was formerly located at the springs.

**Rhome Springs (30)** are two kilometers west of Bullard on Odem Dumas' ranch. The old town of Etna was located here. The city of Bullard obtained water from the springs until 1967, according to Valerie McCugh. The water flows from an old springhouse at an elevation of 151 meters into a bog. Here frogs croak among the pennywort, marsh purslane, common reeds, and flatsedge, in the shade of willows and, in fall, a red-leaved black gum tree. On November 2, 1979, 1.3 lps poured from Weches sand. The water feeds a downstream pond and Flat Creek.

**Dewberry Springs (13)** are nine kilometers north of Teaselville community on Kittie Edwards' ranch. Here, at Camp Johnston, the Texas armies camped in

## STARR COUNTY

1839 before slaughtering the Cherokee Indians. The Edwards house, still standing, was built in 1854 by John Dewberry. A vandalized historical marker stands 100 meters northeast of the springs on Highway 346.

Dewberry Springs were formerly used by the Dewberry or Edwards house. Fish were once plentiful in the pools, according to Mrs. Edwards. On November 2, 1979, the discharge was 1.7 lps from Weches sand and iron ore. The pools are surrounded by hematite iron-ore boulders. Maidenhair spleenwort ferns and mosses cover the damp rocks.

**Neches Saline Seeps (2)** are now beneath the water of Saline Creek arm of Lake Palestine. The seeps encrusted a 2- to 3-hectare area with salt. Prehistoric people made salt here, as indicated by flat pottery salt pans found nearby. In 1765 missionary Jose de Calahorra y Saenz noted that the place was a resort of wild animals and Indians. It has also been called **Gardner's, Brooks, and Bean's Saline** for the various people who made salt from the water.

A salt dome underlies Neches Saline. The salt is dissolved by groundwater from upper Cretaceous rocks and brought to the surface. It was used in early days for curing hides, setting dyes, and preserving meat, as well as seasoning food.

**Lee Springs (32)** were four kilometers east-southeast of Noonday near the Lee Springs church. They were used by the church and three nearby families, according to neighbor A. A. Stell. The springs have been buried beneath sediment and no longer flow. But other springs produced a discharge of 1.0 lps from Sparta sand on November 2, 1979, in the creek just north of the church.

**Springhill Springs (14)** were five kilometers north-northeast of Noonday behind the Jackson Springhill church. They also are now dry.

## STARR COUNTY

Springs have never been very large or numerous in Starr County. This is due to the lack of relief in the relatively flat topography and to the presence of fairly impervious shales under much of the area. However, the springs were more constant and reliable before the advent of European settlers in the area. The springs which still flow are found chiefly in sand and gravel terraces along the Rio Grande and in Eocene, Miocene, and Pliocene sands elsewhere.

These springs were clearly used by Paleo-Indians at least 10,000 years ago. That they were few and far



*Dewberry Springs.*

between is borne out by the following statement of a missionary in the 1750s:

To reach it [the nearest ranch] we must ride under the heat of the tropical sun, over immense sandy plains where we do not find a drop of water to quench our thirsts or a tree to give us shade.

There are small trees now, in the form of mesquite, huisache, anacahuita, and blackbrush, but these were less common as recently as 1850, when grass extended from the river at Rio Grande City to a point 26 kilometers north. It seems clear that severe overgrazing and soil erosion killed off the more desirable grasses and allowed these shrubs, small trees, and huge prickly-pear cactus plants to take over. The floodwater retarding structures built by the U. S. Soil Conservation Service have helped to replace the recharge water lost when the grasses and soils disappeared, but only in part.

An unusual ecosystem surrounds the county's springs. Many Mexican plants and animals extend their range into Starr County but no further. Northwest of Salineno is the only known grove of Montezuma bald cypresses in the United States. Mexican animals found here include such species as the Mexican burrowing toad, giant toad, green jay, chachalaca, and Lichtenstein's oriole. Mammals such as jaguars, ocelots, and jaguarundis, former residents of the area, have disappeared altogether.

Some old watering places were only water holes (*charcos*) or very old wells. For example, Las Comitas on the Margo Ranch eight kilometers west of La Gloria, a well-known water stop 200 years ago, always had a well in historic times, according to foreman Daniel Garza. But other locations in low spots, dry now and usually marked by dense groves of huisache and a windmill, may have had surface seeps at one time.

The spring waters are generally of a sodium sulfate or chloride type, and are slightly saline, very hard, and

of neutral pH. Most of the writer's field studies were made on November 9-16, 1976.

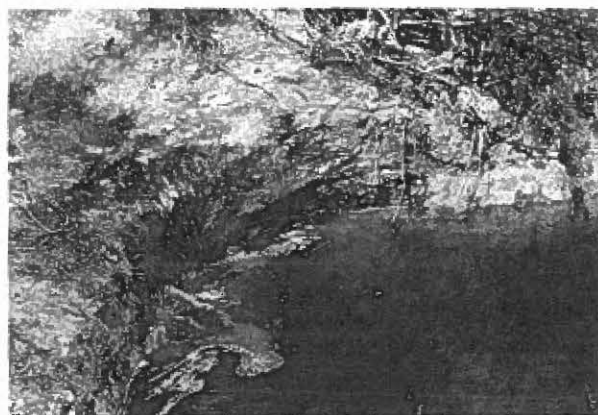
The village of El Sauz northwest of Rio Grande City is named for the willow trees found here, which require shallow water. **El Sauz Springs (5)** are chiefly about five kilometers upstream from El Sauz, issuing from Catahoula tuff. The water is too salty for stock to drink. Salt cedars are numerous, and purple portulacas and white prickly poppies adorn the banks in spring. Raccoons fish for minnows here. On November 9, 1976, 0.52 lps was passing the Highway 649 bridge over El Sauz Creek. On March 21, 1979, there was only 0.05 lps here, but 0.20 lps 3.5 kilometers upstream, on Fidel Perez' ranch. Downstream many archeological sites have been found by Thomas R. Hester, Director of the Center for Archeological Research at The University of Texas at San Antonio. The indications are that this spring-fed stream was a popular place for campsites for many thousands of years.

**Charco al Monte or Charco del Monte** (Waterhole in the Woods) (6) was a well-known watering place shown on old maps. Several archeological sites have been found near here. The charco was 12 kilometers east of El Sauz on the Martin ranch. Formerly fed by very small springs and seeps which emerged at the base of the Bordas escarpment, it was used in historic times by goat herders, according to Isauro Lopez, a nearby resident. Overgrazing, which killed the better grasses and caused an invasion of mesquite, catclaw, huisache, and blackbrush, probably caused the springs to fail.

Two kilometers northeast of Santa Elena, on Beto Montalvo's ranch, were **Santa Theresa Springs (10)**. The old Santa Theresa ranch was located here. In 1852 John Bartlett found the deserted ranch in ruins, with three shallow wells nearby. He found that the water was good. He remarked that the place had been used to capture wild horses, and that the previous year the Comanches had killed the occupants and taken the cattle, mules, and horses. Evidently the wells were dug during a dry period when the springs failed to furnish sufficient water.

Santa Theresa Springs were depicted on the U. S. War Department's 1854 (?) *Maps of military reconnaissances in the military department of Texas*, and on the U. S. Engineer Office's 1892 *Map of the Rio Grande frontier*. Nearby rancher Adam Juarez guided the writer to the site. The springs once trickled from a caliche outcrop in a draw but have long been dry. Capul trees, in addition to the usual mesquite and other brush, now adorn the site.

**Salado (Salt) Springs (2)** on Salado Creek are the



Salado Springs.

largest and best known in the county. Located five kilometers north-northeast of Grulla on the Boone Lagrange ranch, they flow from a gravel terrace on top of a clay bed. According to Kenny Anderson, who leases the land, the springs failed for a time earlier in 1976, but on November 9 they flowed 1.8 lps. At one time a freshwater and several saline springs could be distinguished, but now because of severe soil erosion and flooding they cannot be separated, all being covered by silt and cattails. Many Indian relics have been found here. Settlers around 1760 and perhaps earlier also made good use of the springs.

**Agua Verde (Green Water) Seeps (11)** were 12 kilometers north-northeast of Roma on Ernesto Salinas' ranch. On Arroyo Grande, they flowed from Jackson sandstone. According to Abel Munoz of Roma, there was still seepage into a water hole called **Las Tinajas** until about 1967. The water was much used by early residents. Now there is only mesquite, huisache, catclaw, and other brush.

Three kilometers west of Roma, at the mouth of *Arroyo de los Indios* (Indian Creek) on Mario Ramirez' ranch, are **Indian Springs (4)**. On November 9, 1976, they flowed 0.11 lps from terrace sands on top of an Eocene oyster bed. Towering above the springs is a bluff or *fronton* for which the nearby village of Fronton is named. According to Manuel Robles, who lives here, the spring water is moderately saline, but is drunk by cattle on occasion. These springs must have been very important to the early settlers around 1750. Five kilometers upstream from Roma, on the Mexican island of Los Adjuntos near Mier, are some mineral springs which were very popular for baths in 1857, according to explorer W. H. Emory.

In 1655 the Spaniard Fernando de Azcue with a force of about 400 men crossed the Rio Grande near Mier in pursuit of a band of Cacaxtle Indians. He may



have stopped at the very small springs (7) along Arroyo Laminita, 11 kilometers southeast of Falcon Dam. On November 12, 1976, they produced 0.12 lps of iron-bearing water from Jackson sandstone, and on March 2, 1979, only seeps. Minnows dart in the pools, shaded by sand-bar willows, where raccoon and coyote tracks are numerous. These springs have undoubtedly benefited from recharge into the sands by Falcon Reservoir, a short distance upriver, whose impoundment began in 1953.

## STONEWALL COUNTY

Stonewall County lies in the Rolling Red Plains, where Permian formations such as the San Angelo, Blaine, Dog Creek, Whitehorse, and Cloud Chief crop out, dipping gently toward the west. Small springs issue from gypsum, sandstone, and dolomite in these formations. Large areas of the Permian, especially near the Brazos River, are covered with deposits of Seymour sand and gravel. These are ancient stream deposits up to 15 meters thick. Most of the stronger springs trickle from the Seymour at its contact with the underlying Permian shales.

Cavernous gypsum is one of the more important aquifers. Many gypsum caves were formed by solution of the gypsum by running water. Some of the largest gypsum caves in the world are found in Stonewall County. These include Creek Cave and Aspermont Bat Cave.

The usual spring vegetation includes willow, cottonwood, salt cedar, and hackberry trees, cattails, and rushes. On the more sandy areas shinnery, live oak, post oak, plum thickets, and algerita shrubs are common. Mesquite trees, of course, are found everywhere. Cedar trees thrive in the red-bed breaks.

In 1886-87, 1917-18, 1943, and 1952-56, severe droughts caused most springs to dry up temporarily. A permanent decline in spring flow has been caused chiefly by well pumping and overgrazing.

Disastrous modern gully erosion as well as sheet erosion has taken place where moderately sloping land was placed in cultivation. Such land, of course, should never have been plowed. As a result, many stream channels have been choked with sediment and springs buried.

The spring water is usually of a calcium or magnesium sulfate type, slightly saline, very hard, and alkaline. Some contamination has been caused by improper disposal of oil-field brines. But some springs and seep areas contain very high contents of natural sodium chloride.

Most of the writer's field studies were made during the period September 2-7, 1979.

Eleven kilometers west of Aspermont are **Stinking Springs (8)**, on L. L. Boyles' ranch. Also called Skinner's Pocket at one time, the springs feed Stinking Creek. Travelers in 1896 remarked that the springs were true to their name and contained much sulfur. On September 5, 1979, seepage from Blaine gypsum fed two earth tanks. Swamp grasses and much algal growth are present. Hawks and dragonflies hover overhead.

In northwestern Stonewall County are **Salt Flat Brine Springs (6)**, at latitude 33°23' and longitude 100°26'. They are similar to Dove and Haystack Brine Springs which flow just over the line in King County. The largest of the Salt Flat Brine Springs is actually a flowing well which produced about 1.1 liters per second when the casing was removed in 1955. In May, 1961, a total discharge of 5.7 lps was measured at an elevation of 520 meters.

The salt is leached from Dog Creek shale. Recharge takes place through collapse areas and sinkholes in the gypsum and gypseous shale on the neighboring uplands. The dissolved solids content can reach 222,000 milligrams per liter (see table of Selected Chemical Analyses), making this one of the saltiest springs in Texas. The water can be over six times as salty as sea water. It also contains 80 milligrams per liter of bromide.

Numerous brine seeps at Salt Flat Springs produce a salt flat covered with cubical halite crystals. No vegetation grows on the flats, but salt-cedar trees fringe the area.

Near the King County line about nine kilometers east of the northwest corner of Stonewall County, is weir D on Salt Croton Creek. Here the U. S. Geological Survey has measured the total amount of salt produced by Salt Flat Brine Springs and the neighboring Dove and Haystack Springs in King County. The discharge records, in lps by water years, follow:

1957	30	1968	31
1958	26	1969	34
1959	21	1970	21
1960	20	1971	23
1961	20	1972	32
1962	20	1973	28
1963	17	1974	17
1964	16	1975	18
1965	18	1976	20
1966	25	1977	31

Two kinds of minnows, some bright blue and others greenish tan, live in the water. They probably feed on the abundant tiny brine shrimp. Tiger beetles dart along the pool shores.

It was estimated by Baker and others (1964), that 300 tons of chloride and 8 tons of sulfate are produced daily by these brine springs. Plans are under way to pipe the brine to a proposed lake in southeastern King County, where the water will be allowed to evaporate.

On the east bluff of the Brazos River 15 kilometers north of Swenson are **Dripping**, or **One Thousand Springs (4)**, adjacent to Jake Hall's farm. Perhaps Jose Mares stopped here in 1788 on his return from San Antonio to Santa Fe. Ray Mitchell of Carrizo Springs was born nearby and often swam in Dead Man's Hole at the springs. Steps have been cut in the cliff rock to facilitate access. The water drips from a 2.5-meter-thick bed of Blaine gypsum on top of shale for about 400 meters along the bluff. It probably enters the fractured gypsum from Seymour sand and gravel which overlies it to the east. The gypsum dips gently to the west, toward the river.

On September 7, 1954, Horace Blank (1955) estimated the discharge of slightly saline water from Dripping Springs to be 3.2 lps. On September 5, 1979, there was only seepage. Much vauquel bush occurs here in addition to the usual spring vegetation. Raccoon, coyote, and bird tracks are numerous in the river mud.

Similar springs occur on Tom Hill's property two kilometers north and three northeast of Dripping Springs. On April 12, 1950, each produced 2.8 lps, but on September 5, 1979, they also were only seeps.

**Ward Springs (2)** are eight kilometers north-northwest of Aspermont on Tom Hill's ranch. In 1890 Edward Featherston stopped here. He found a flock of 50 turkeys, many quail, and three antelope near the springs. An Indian campsite also existed here at one time. On September 5, 1979, runoff from a recent rain covered the very small springs. Frogs and crawfish live in the pools, shaded by white-flowered vauquel bush.

**Beidleman Springs (3)** are 13 kilometers north-northwest of Aspermont on Ida Marr Denison's property. Here the bones of extinct bison have been found mingled with Plainview projectile points. Evidently this was a killsite, some 10,000 years ago, where the animals possibly were driven into the bog surrounding the springs and slaughtered. On September 5, 1979, there was only seepage into pools from Quaternary gravel on Permian shale. A lone cottonwood stands near the springs, along with the usual spring vegetation. Numerous birds frequent the site.

Five kilometers west-northwest of Kiowa Park in northeast Stonewall County are **Pike Springs (13)** on Wedington Creek. This was a favorite haunt of Indians in past millennia. In 1832 Albert Pike, traveling eastward,

wrote of the springs (Haley, 1969):

About ten we arrived at a large clear limestone spring of water, where we stopped and drank plentifully; from this spring, a small stream of water ran down the valley, in a course nearly north-east. We followed the valley down, and crossed this hollow about forty times. The valley was full of horse-tracks and signs of Indians; and still, the temptation of a large catfish or two which we saw in the spring under the shelving rocks, was enough to induce us to fire a shot or two at them, which, however, was unsuccessful. About two miles below the spring, we encamped on the edge of the branch, in green, heavy grass, and close to an abundance of hackberry trees, with good fresh water. The valley was here running a course nearly northeast—and after dinner, we continued that course, until, weary of crossing the creek, we bent more to the east and left it to our left; crossed the point of a hill and left a high and conspicuous conical hill [Kiowa Peak] to the right, about six miles beyond which we emerged from the broken hills into the mesquite, covering the bottom on the edge of another river [Brazos River].

Pike Springs are on Leslie Brown's ranch, leased by W. W. Walton. They trickle from Blaine gypsum and terrace sand, starting about three kilometers above the mouth of Wedington Creek and running to the mouth. On September 6, 1979, the discharge at the mouth of Wedington Creek was 0.71 lps. Evidently the spring flow started farther upstream in Pike's time.

In the northeast corner of the county, about one kilometer south of the butane plant in the east bluff of the Brazos River were formerly some springs (14). Here evidence of an Indian village and many buffalo bones have been found. The springs, on S. S. Dozier's property, trickled from Seymour sand and gravel. On September 6, 1979, they were dry. Many oil wells pump nearby. The site is littered with shotgun shells.

Ten kilometers south of the northeast corner of the county, on the east side of the Brazos River, are **F2**, or **Hooker Springs (22)**. They pour out of Seymour sand and gravel on Permian shale on Wayne Speck's ranch, leased by Wimpy Hollingsworth. On September 9, 1979, the flow was 1.3 lps. The springs feed a fishing and livestock lake, where a private picnic table and grill have been installed. Grassland is irrigated with the water. Mexican ground squirrels dart among the willows and salt cedars.

In a remote area of northeast Stonewall County at latitude 33°18' and longitude 100°02' were **Beaver Springs (12)**. This is a "badlands" area, with no human habitation within 15 kilometers. Nearby is an old stone building, possibly a Spanish mission or fort. On September 6, 1979, there were only small seeps from San Angelo sandstone. Of course, the beavers are gone.

Springs (9) once flowed on Robert Gholson's ranch 17 kilometers north-northeast of Aspermont on the south side of the Salt Fork of the Brazos. The water formerly flowed from Blaine gypsum into a trough, watering 60 head of cattle. On September 6, 1979, there was only a seep. Slightly lower and closer to the river are some saline springs.

**Rock Springs (1)** are the source of Rock Creek, 11 kilometers northeast of Aspermont, partly on B. O. Hawkins' ranch. On September 4, 1979, after a one-centimeter rain the preceding day, 4.1 lps of slightly saline water was reaching the mouth of the creek. Two days later the flow had dropped to 2.1 lps. The water issues from Blaine gypsum and sandstone. Minnows and frogs swim among the water milfoil. Damsel flies alight on the vauquel bushes and other spring vegetation.

**Whiskey Springs (10)** are 14 kilometers northeast of Aspermont in a spring canyon on the north side of the Salt Fork of the Brazos. They trickle on John Metcalf's ranch, operated by Clyde Trammell. There are rumors of buried Spanish treasure near here. The water was used to make bootleg whiskey. The ghost community of Sandlin is just northeast. On September 6, 1979, 0.12 lps issued from Blaine gypsum.

Wilfong Creek (11), 15 kilometers north-northwest of Old Glory on J. C. Moorhouse's ranch, is spring-fed. On September 6, 1979, 1.9 lps passed the road crossing near the creek's mouth. The water trickles from Blaine gypsum. Frogs and blue damsel flies frequent the springs. Oil wells pump nearby.

Thirteen kilometers north of Old Glory on the south bluffs of the Salt Fork of the Brazos are **McBroom Springs (17)**. They are on Carl Hunt's ranch, leased by Ned Ward. They seep from Seymour sand and gravel and San Angelo sandstone along an 800-meter stretch of the bluffs. The water probably originates from the overlying Seymour sand and gravel to the south, where numerous closed drainage basins and sinks occur. On September 7, 1979, the total discharge was estimated to be 6.5 lps. The water was once used to irrigate a four-hectare garden.

The high-level McBroom Springs are only slightly saline, containing 1,130 milligrams of dissolved solids per liter. The low-level springs near the river produce very saline water containing 12,100 milligrams of dissolved solids per liter. The high-level springs feed an earth tank in which large fish swim. Around the springs are many boggy areas where water cress, pink-flowered ironweed, and seepwillows grow.

Fifteen kilometers north-northeast of Old Glory are

some similar springs (21) on the southeast side of the Salt Fork of the Brazos just above its confluence with the Double Mountain Fork. On Tom Simpson's ranch, they feed two earth stock tanks. In winter one of the tanks overflows at a rate of around 1.3 lps.

**Cottonwood Springs (15)** are 10 kilometers east of Aspermont on Tonk Creek on Charles Abernathy's ranch. Tonk Creek was evidently named for the Tonkawa Indians who once frequented this area. In 1872, General Ranald Mackenzie camped here while chasing Indians. He called it "the vilest of water." Flowing from Blaine gypsum and sandstone, the water does give off an unpleasant hydrogen sulfide odor. Lt. Col. Buell depicted Cottonwood Springs on his 1874 map of a *March from Ft. Griffin*.

On September 7, 1979, Cottonwood Springs produced 1.5 lps, which ran about 10 kilometers down Tonk Creek. The water is now moderately saline, containing 2,100 milligrams of chloride per liter. Many oil wells pump upstream. Minnows and frogs dart among the algae-laden water milfoil. Many birds chatter in the trees. But the cottonwoods are gone.

Four kilometers west-southwest of Old Glory is the old Rayner courthouse, the first county seat in 1888. Bill and Ida Denison now live in the old building. Just to the west were **Rayner Springs (16)**, where settlers of the community obtained their water. On September 7, 1979, there were only seeps from Blaine gypsum and sandstone. Frogs jump in the pools among cattails and willow trees.

Along the south side of Double Mountain Fork of the Brazos River in southern Stonewall County are several springs (18-20), on W. F. Martin's ranch, managed by John D. Ferguson. Kenneth Scifres guided the writer to them. Sixteen kilometers south of Aspermont are **Moore Springs (18)**. Brinkley Moore settled here in the 1880s. The water flows from a large opening in Blaine gypsum. After a dog got wedged in the cavity and died, bars were placed over the opening. On September 8, 1979, there were only seeps into pools, but the springs are said to flow most of the time. Raccoon and turtle tracks may be seen here. According to Scifres, the water has been contaminated by oil-field brines.

Two kilometers south-southeast of Moore Springs are two graves on the W. B. Trammell ranch, leased by Elbert Payne. This is all that remains of the 1876-79 buffalo-hunter's camp called Rath City or Reynolds Camp. At one time 1,100,000 buffalo hides are said to have been stacked here. The buffalo hunters probably obtained water from Moore Springs. They may also





Graves at site of Rath City near Moore Springs.

have used Willow Springs, now only a seep, 1.6 kilometers west of Rath City. A historical marker is on Highway 83 to the east, just north of Double Mountain Fork of the Brazos River.

**Martin Springs (19)** are four kilometers north-northwest of Rath City near the Double Mountain Fork. In 1887, pioneer surveyor O. W. Williams described conditions around these springs (Myres, 1966) as follows:

A few days later, our party took the road back across Rock, Red Mud and Duck creeks to camp one night by a clear gypsum spring on Double Mountain Fork, some two miles out from a kind of hunters' headquarters known as Rath City, consisting of one store, two saloons and a dance hall. Early the next morning we heard some shots fired at some point between us and the "City." On our way in, we came to a bend in the road where there were signs of recent bloodshed. In the town we were told that "Spotted Jack" had been killed that morning at that spot, but no one was able or willing to tell us why or by whom he was slain. Later we learned that he was a noted horse thief; but that was all we got out of the story.

Spotted Jack's grave is one of the two remaining at the site of Rath City. On September 8, 1979, Martin Springs produced 1.0 lps from Blaine gypsum, which flowed to the river. The springs pour into a pool which has been cleaned out, shaded by cedar and live oak trees. Pink-flowered ironweed and vauquel bushes thrive here. Raccoon tracks are numerous. The water is pumped up to stock troughs on the ranch.

Four kilometers west of Martin Springs, also on the Martin Ranch, on Gyp Creek are some gypsum springs (20). On September 8, 1979, there was only seepage from Blaine gypsum. The dissolved-solids content of the water has been measured at 4,460 milligrams per liter.

## SUTTON COUNTY

The springs of Sutton County flow chiefly from

Lower Cretaceous limestones and sandstones, primarily the cavernous and vugular Edwards and associated limestones. All of these formations dip toward the southeast at about two meters per kilometer. Nearly all of the springs flow in the extreme eastern part of the county.

Native Americans made good use of the county's springs. As long as 15,000 years ago hunting and gathering Paleo-Indians camped here. Later the Archaic Basket Makers lived near springs while cultivating corn, tobacco, and squash. At the dawn of history in the area, the Lipan Apaches were living here.

Well pumping and overgrazing have been the chief factors causing a decline in the water table. As a result many springs have dried up. In the very wet year of 1974, many springs were temporarily rejuvenated, but the general trend has been toward failure.

The springs are the sites of a complex biosphere. Water cress, water lilies, cattails, and maidenhair ferns are shaded by willow and other trees. Fish, crawfish, snakes, turtles, waterfowl, and the larger animals which prey upon them thrive in the springs' environment. As the springs dry up, many of these plants and animals also disappear.

The spring waters are generally of a calcium bicarbonate type, fresh, very hard, and alkaline. Most of the writer's field studies were made during the period December 12-17, 1978.

**Pecan Springs (8)** are 14 kilometers northwest of Roosevelt on West Copperas Creek. On Elmer Wilson's ranch, they issue from cobbles on top of Edwards limestone at an elevation of about 670 meters. On December 15, 1978, the discharge from these and other springs reached a maximum of 13 liters per second two kilometers downstream from the head springs. Live oak, pecan, and cedar trees with grape and dewberry vines adorn the surrounding slopes. Ducks and nutria frequent the pools. At the Joy ranch house downstream additional springs drip from a limestone bluff amid maidenhair ferns. The water is piped to the ranch house and stock.

In eastern Sutton County on the headwaters of the North Llano River at Fort Terrett are **Fort Terrett Springs (16)**. The fort used the water from 1852 to 1854. At that time thousands of wild turkeys roosted nearby. The buildings have been restored by W. D. Noel and are cared for by Terry Schenkel. Kingfisher Water Hole is also located here. Two small dams have been built to catch the spring water. On December 15, 1978, a discharge of 0.55 lps of fresh water was passing the lower dam as leakage, at an elevation of 625 meters. The recharge water apparently enters the Edwards

limestones to the northwest along North Llano Draw.

The springs evidently started about one kilometer farther upstream in former times. About 25 bedrock mortars and many burned-rock middens have been found, extending upstream from the present springs. Petroglyphs and pictographs decorate caves on the high bluff of Edwards limestone upstream. The lakes were stocked with catfish and bass which were all killed in a freak accident. A storm upstream brought tons of hailstones into the lakes, and the fish died of the shock. Ducks, deer, and many exotic animals such as camels, ostriches, and llamas are protected here. The water is used to irrigate six hectares of alfalfa.

Two kilometers downstream are the large **Adams Springs (7)**, on Viola Adams' ranch. Here a very vugular bed of Edwards limestone crops out in the North Llano River channel. One large and many smaller springs burst into the north side of the river, chiefly below the water level. Although there is still much disagreement as to his route of travel, De Vaca may have passed this way around 1530.

At the bridge downstream (three kilometers below Fort Terrett) there was a discharge of 360 lps on February 7, 1925. On December 15, 1978, the flow at this point was 420 lps. Water cress and maidenhair ferns adorn the pools. Raccoon tracks are numerous along the shore. Minnows, sandpipers, and herons live here. Pecan trees and baccharis shrubs line the banks.

One and one-half kilometers downstream from Adams Springs are **Cedar Hill Springs (6)**. They are across the North Llano River from Cedar Hill school. They provided water for the school until it closed in the 1930s, according to Gene Adams. A steel drum has been placed around the springs. On December 15, 1978, they produced 5.7 lps. Water cress, water lilies, pennywort, and milfoil brighten the pools. Turkeys and nutrias make their home here.



Adams Springs.

**Logan Springs (5)** are another 2.5 kilometers downstream on Gene Adams' ranch. Here D. Q. Adams built a cabin in the 1880s. Caves in the adjacent bluff probably provided shelter for native Americans who lived here long ago. Water cress and pondweed float in the pools, shaded by live, white, and Spanish oaks and sycamore trees. As the water boils up from a crevice in the rock beneath the river's surface, its discharge cannot easily be measured. (See Plate 11, a). At the road crossing of the North Llano River just west of the Kimble County line there was a discharge of 760 lps on December 15, 1978.

Upstream from Fort Terrett there were once many pools of live water on the North Llano River and its tributaries. Ten kilometers west-northwest of Fort Terrett on Tenmile Draw is **Little Ogden Water Hole (9)** on Jack Baker's ranch. His grandfather once told him of a camp and very small spring which formerly existed two kilometers east of this water hole. Two kilometers south of Little Ogden Water Hole is the 300-meter-long **Tenmile Water Hole**, also on Tenmile Draw. **Ogden Water Hole** is two kilometers southwest of Little Ogden on Mrs. Albert Schultz' ranch on the North Llano River. These and other nearby water holes are no longer fed by seepage, but hold surface water for a time after rains.

**Eightmile Water Hole (4)** was 10 kilometers west-southwest of Fort Terrett on the J. Sentell ranch, leased by George Wallace. It formerly contained live water from the Edwards limestone, and bass, according to nearby rancher Bill Wade. In 1948 it was filled with gravel during a flood.

A second **Tenmile Water Hole (3)** is four kilometers southwest of Eightmile Water Hole, also on the Sentell ranch. According to Wade, this water hole also contained live water, from the Georgetown limestone, and fish, but not since 1922. Now a nearby windmill pumps water into an earth tank. These and other unnamed water holes on Eightmile Draw, many on bedrock, now hold water only briefly after surface runoff.

Close to the Crockett County line at latitude 30°24' were **Taylor Box Seeps (1)**. On Carrie Kames' ranch, they were at the mouth of Taylor Box Draw on Taylor Box Road. According to Hillery Phillips, Sr., who owns a nearby ranch, a man by the name of Taylor placed a wagon bed around the seeps to collect the water in the 1890s. Many early settlers came here to obtain water. Now the site is dry and covered with flood-borne cobbles and gravel. Live oak, cedar, hackberry, and mesquite trees with much mistletoe cover the area. Some

say these seeps were upstream on Taylor Box Draw in Crockett County, but the Sutton County location appears more likely.

**Willow Springs (1)** were 25 kilometers west-southwest of Sonora at the mouth of a draw entering Devil's River on William Becker's ranch. They were important to early settlers and Army units. Livemore's and Butterfield's 1881 *Military map of the Rio Grande frontier* and A. W. Spaight's 1882 *Official map of the state of Texas* depicted them. According to Lee Roy Valliant of Sonora, a school and church once used the water, which poured from a bluff of Georgetown limestone adjacent to the draw. Clyde Hill of Sonora remembers when the springs still seeped around 1918. There was a large willow tree at the site then. An old road passed the springs, and many travelers obtained water here. According to W. L. Whitehead, who ranches nearby, boys used to swim in the pool in the channel fed by the springs. As the seeps stopped flowing, the pool area was deepened, but to no avail. It has long been dry. A grove of live oaks still stands at the spot.

## SWISHER COUNTY

Most of the springs of Swisher County flow or once flowed along Tule Creek and other streams where there is some topographic relief. They issued from Quaternary sand such as the Tule formation, Tertiary Ogallala sand and gravel, and Triassic Dockum (Santa Rosa) sandstone. Water from the Ogallala formation often sinks into the Dockum sandstone, from which it issued as springs.

As long as 15,000 years ago, early Americans lived at the springs and along spring-fed creeks. At that time all of the Tule Creeks flowed abundantly. *Tule*, incidentally, is Spanish for *Rush*. The lakes were full, providing havens for ducks, geese, herons, sandpipers, killdeer, and other wildlife. Many Spanish explorers as early as the sixteenth century paused for refreshment at the county's springs. In 1909 a brochure described the perennial flow of "genuine freestone water" in North, Middle, and South Tule Creeks, which abounded in bass and catfish. Many county residents still remember much spring water in these creeks.

The spring-fed streams supported a unique assemblage of plants and animals. Bears, panthers, wolves, antelopes, wildcats, turkeys, and prairie chickens were abundant. Wild plums and grapes were plentiful. Most of these animals and plants have now disappeared along with the springs. Man's activities, especially pumping groundwater for irrigation, have caused a

severe decline in the water table. In the southern part of the county the decline was about 25 meters from 1937 to 1967. This is the major cause of the failure of most springs. All streams are now dry other than for storm runoff, except extreme eastern Tule Creek. In addition, soil erosion has filled many stream channels and buried some springs. As a strong base flow no longer exists on Tule Creek, there may be trouble in the future in collecting sufficient water in Mackenzie Lake.

The water is generally of a calcium bicarbonate type, fresh, very hard, and alkaline. The content of silica and fluoride is usually high.

Most of the writer's field studies were made during the period September 6-11, 1978.

Long-time residents remember no perennial flow in Happy Draw in northern Swisher County since the early 1900s. But originally there probably were seeps (6) which fed the draw and its lakes, when the water table was much higher than at present.

All other springs of consequence are or were along the Tule Creeks. Let us start at the east end of Tule Creek at the Briscoe County line and discuss the springs going up the three branches, starting with North Tule Draw.

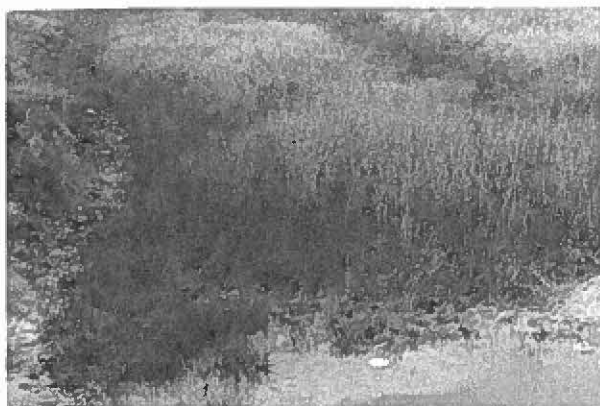
In the western part of Mackenzie Lake Park are **Rogers Springs (4)**. On November 12, 1945, the discharge was 0.32 liter per second. On September 7, 1978, there were only some seeps from Triassic sandstone into standing pools of water. The springs are said to flow in winter. A few cottonwoods shade the ravine in sandstone with vertical bluffs. Nearby is the Rex Rodgers archeological site, where ancient Clovis or Plainview people killed bison.

Four kilometers east-northeast of the Highway 2301 bridge were **Dead Horse Springs (5)** on the Rogers estate, leased by Ray Adams. Here in 1874 Gen. Mackenzie ordered 1,048 Comanche horses shot, in order to cripple the Indians' ability to fight. Charlie Herring, who lives nearby, remembers when the bricked-up springs provided water for the ranch house and cattle in 1932. Now they are dry and even the bricks are buried. A grove of cottonwood and elm trees stands here.

Upstream, at the Highway 2301 crossing of Tule Creek, are **Prairie Dog Springs (3)** on Charlie Herring's farm. According to Herring, these springs formerly formed mounds of sand, which gave them their name. On September 4, 1978, 0.04 lps still seeped from Tule caliche. Minnows dart in the pools, fringed with rushes and water cress. The "prairie dog" mounds are long gone.

About one kilometer northwest of the bridge were





*Prairie Dog Springs.*

**JA or Anderson Springs (1)**, on John Herring's farm. Here in 1883, Charles Goodnight built a log cabin which is now in the Tulia museum. The springs fed an earthen tank. In 1919, according to T. P. Anderson of Tulia, the tank still overflowed, providing a constant flow of water downstream. The springs have been dry for many years. The dry tank is surrounded by cottonwoods, many now dead. Black soils indicate that a large swamp once existed here.

About 500 meters farther upstream were **Hackberry Springs (2)**. Some human skulls were found here in 1922, according to Anderson. Probably they were the remains of a prehistoric people who lived at the springs. Now there are only some seeps in Tule Creek channel among some hackberry trees.

**Pike Springs (8)** were two kilometers farther upstream on John Earl Simpson's property. They flowed until 1967, and then maintained only pools of live water until 1974, when they dried up permanently. Cottonwood and elm trees still stand here.

Just west of Pike Springs was a strong spring from Ogallala caliche near the R. B. Dawson house. According to D. A. Dawson of Tulia, this spring produced a 4-inch (10-centimeter) diameter stream of water in the 1920s. It stopped flowing in the 1930s and is now covered with sand.

Five kilometers downstream from the Highway 1318 crossing of Tule Creek were **Dawson Springs (9)**, on D. A. Dawson's farm. The ill-fated Santa Fe expedition camped here in 1841 while en route from Austin to New Mexico. A stone axe belonging to a long-ago resident at the springs was found here. The springs ran well until the 1930s, when some were buried, according to Dawson. The creek flowed here in winter until the early 1960s, when it dried up completely. Many irrigation wells pump in the surrounding

area. A few cottonwood trees still survive along the creek.

About one kilometer downstream from the Highway 1318 crossing were **Elkins Springs (10)**. Here Henry and Louisa Elkins settled in 1885. The springs have long been dry, but their location is marked by a strip of cottonwood, willows, and hackberry trees along the creek. The site is on O. B. Barnes' property, leased by Kenneth Hall.

Just upstream from the Highway 1318 crossing were other springs (11), now on Neal Davis' farm. Here Dub and Mattie Foster built a cabin in 1917. Their boys fished and swam in Tule Creek. The springs failed in the 1930s. A grove of trees, including dead cottonwoods, still stands along the creek.

Two kilometers upstream from the Highway 1318 crossing were **Edwards Springs (12)**. The owner, Mrs. Louis Edwards, grew up here, learning to swim and fishing for catfish and perch in the springs. According to neighbor A. D. Lee, the springs and creek flowed here only in winter in the 1940s and early 1950s. During this time subirrigated alfalfa was grown on the floodplain. Alfalfa's roots can reach down as much as 9 meters for water. Around 1956 the springs dried up.

Proceeding up North Tule Draw, **Poff Springs (13)** were about one kilometer downstream from the Highway 146 crossing and five north-northeast of Tulia. C. C. Poff built a cabin here in 1890. The site, in a grove of trees, is now on Jim Kiker's property. Jose Mares may have paused here in 1787-88 on his journey from Santa Fe to San Antonio or on the return trip. According to Archie Jordan of Tulia and Fred Briggs of Happy, these springs ceased flowing around 1940. A well pumps at the former springs now.

Four kilometers downstream the spring waters fed a swimming hole. J. T. Barnett used to swim here in 1931-32. In the 1930s Tule Lake was built at this point to collect the spring-fed water. It was very popular for fishing and boating, and a Girl Scout camp was established on the lake. In recent years, however, with failing spring flow the lake has been dry most of the time. Many dead trees fringe the former shore. It is doubtful that the lake will ever again provide the recreation for which it was intended.

Farther upstream, at the Highway 1424 crossing of North Tule Draw, were other springs (14). In 1841 the Santa Fe expedition camped here. There is some disagreement as to whether these springs still flowed in 1930, but a good swimming hole is said to have existed here then.

Now to proceed up Middle Tule Draw, **Faulkner**

**Springs (15)** were in the present Mackenzie Park in southeast Tulia. Here in 1889 F. M. and Luella Faulkner built a dugout surrounded by cottonwood trees. A natural rock crossing of the creek existed here. A deep hole was used for baptisms. Mrs. August Vaughn remembers the springs and cottonwoods in 1915. According to J. T. Barnett they continued to flow until the 1930s. The pools were used for ice skating in the winter. (The flow must have been very weak by this time, as a strong spring flow at a temperature of 16° Celsius would not easily freeze). Now elm trees have replaced the cottonwoods at the dry site.

Just above the Highway 87 bridge were other springs (16) on Mrs. Ray Bivins' land. Mrs. August Vaughn remembers a picnic here in 1932. Now a dry caliche pit occupies the site, with a few hackberry trees.

Three kilometers upstream from Highway 87 were **Maupin Springs (17)**, on the old Maupin place now owned by Mrs. Ray Bivins. An old dugout was located here. These springs flowed until the 1920s, according to Archie Jordan. Now a few hackberry and elm trees mark the dry spot.

Three kilometers farther upstream is J. T. Barnett's home. When he arrived here in 1926 he dug a shallow hole in dry Middle Tule Draw and found water at a depth of 0.6 meter. This was used for household purposes until a well could be dug.

Upstream, five kilometers past the Highway 87 crossing, were **Hardy Springs (18)**, the site now on Larry Hendricks' farm. When William Hardy settled here in 1916, there were many baptisms and swimming in the water hole. An annual fish fry utilized fish caught in Middle Tule Creek. The headwaters of the creek here are rolling, with considerable relief. It is not difficult to imagine copious springs at one time along the creek, although it is dry now. A few buildings and a grove of elm trees, mostly dead, still stand here.

Moving now to South Tule Draw, there were once springs (7) just downstream from the Highway 86 bridge on John Earl Simpson's property. L. D. Young says they ran until the early 1940s. A deep caliche pit here is now dry. Many irrigation wells pump nearby. A few holes of water are reported to have existed upstream. In prehistoric times there very likely were seeps and very small springs along the creek well to the west of Highway 87.

## TARRANT COUNTY

Many thousands of years ago Clovis man and other prehistoric people camped at the abundant springs in Tarrant County. In the early eighteenth century the

Wichitas of the High Plains were forced into Texas by the hostile Osages and Comanches. For a time they occupied the spring sites in Tarrant County. By the 1840's, when white settlement of Tarrant County began, many remnants of tribes which had been forced out of more eastern areas were living along the spring-fed streams. These included Cherokees, Creeks, Seminoles, Caddoes, Kickapoos, Shawnees, and Anadarkos.

Because of heavy municipal and industrial pumping, water levels have declined as much as 230 meters. As a result, nearly all of the county's springs have failed.

The county's spring waters are generally fresh but occasionally slightly saline. Woodbine sand water is usually acid, whereas water from the limestones is alkaline. The Woodbine water is usually soft, but other spring water is likely to be very hard. The principal dissolved solids are calcium and bicarbonate, but sodium and sulfate predominate in some cases.

Most of the writer's field studies were done on December 22-28, 1975, but many later visits were made.

When Major Ripley Arnold arrived to establish Fort Worth in 1849, high grass covered the bluffs and the Trinity River valley. Cottonwood, oak, pecan, elm, and hackberry trees were growing along the Trinity River. Bison, deer, bear, antelope, and wolves were plentiful. As described by Sergeant (1953):

The next morning after a ride of ten miles they came to a high bluff overlooking the river. At the foot of the bluff was cold, clear spring water. This spot had been used by Indians as a camp site for many years. The spring water furnished water throughout all seasons. Its supply did not fail when the river was reduced to stagnant pools in the hot summers. This spring served the early settlers as well as the troops and was known as Cold Spring. When the town grew into a city, many wells were sunk in the vicinity, and the spring's location was lost.

**Cold or Terry Springs (2)** appear to have been near the present M-P Industries plant at 1301 Cold Springs Road.

Several other springs, including **Daggett Cold Spring**, flowed in the area. Some were at Trader Oaks Park at Northeast 10th Street and Samuels Avenue, some at the Samuels Avenue crossing of the Trinity River, and some at the T and P Railway crossing of the Trinity, where Gilmore Creek enters the river. Since those at the M-P Industries plant were the closest to the old fort, it appears likely that these were the springs known as Cold Springs. Gordan Kelley, a Fort Worth historian, favors this view.

Cold Springs flowed from river terrace sand and gravel. They were surrounded by a grove of giant oak

and pecan trees, and were a social center until the 1880s. Here the early settlers, including a school on the bluff, obtained their water. From 1849 to 1876, when artesian wells were drilled, tank wagons delivered water from Cold Springs around the city. Many May Day and Fourth of July celebrations were held at the springs. In 1949 they were described as "faintly bubbling." The springs area has been greatly disturbed by railroad tracks and other construction, and all of the springs in this vicinity are now completely dry. Most are still marked by cottonwood and willow trees.

**Crystal Springs (20)** are adjacent to the West Fork of the Trinity River near the junction of Roberts Cutoff and White Settlement Road. They are in a trailer park owned by Joe Cloud and managed by Lee McCormick. Until 1959 a popular swimming pool and ballroom were located here.

On July 8, 1979, Crystal Springs still seeped from river terrace gravel into three ponds, but no overflow occurred. The ponds, which contain water milfoil, duckweed, and considerable algae, are a home for bass, catfish, frogs, and turtles. Cottonwood, willow, and sycamore trees fringe the shores. Red foxes, raccoons, ducks, and blue geese have also been seen here.

**Allen Springs (18)** are at the crossing of Las Vegas Trail over Farmers Branch in White Settlement. Here William Allen and his wife settled in 1857. The restored log cabin stands at the springs with a historical marker. In the severe drought of 1886-87, settlers from the surrounding very dry area drove their cattle to these springs, according to Frances Allen, Tarrant County historian. Cattails and arrowhead plants are numerous, and willow and hackberry trees fringe the banks. Red-winged blackbirds nest in the shrubs while turtles sun themselves on logs. The water trickles from lower Cretaceous Goodland limestone. On July 9, 1979, the discharge was 0.33 liter per second here, increasing to 1.0 lps at the civic center one kilometer downstream (east). On June 5, 1980, the flow was 0.38 lps, increasing to 1.5 lps at the civic center.

**Tonkawa Springs (19)** are on Silver Creek just west of Lake Worth and six kilometers northwest of White Settlement. Here, about 1850, Comanches and Caddoes attacked a Tonkawa village. The Tonkawas were taken into Fort Worth for protection. The water issues from Paluxy sand, producing 4.5 lps on July 9, 1979. Turtles, frogs, green herons, whirligig beetles, and dragonflies make their home here. Duckweed covers the quieter pools, in a grove of cottonwood, willow, sycamore, and oak trees.

**Burger or Sand Springs (5)** are located near the

intersection of Sandsprings and Meandering Roads in northwest Fort Worth. The water appears from a gravel terrace on the West Fork of the Trinity River in a large swamp surrounded by a jungle of shrubs, grapevines, and cattails. Lake Worth, built in 1914 immediately upstream, probably now helps to recharge the springs. However, the springs existed before Lake Worth was constructed. The former owner, Mrs. H. G. Burger, used the springs to feed several ponds where she raised goldfish and minnows.

Burger Springs now feed Burger Lake, a swimming and recreational resort operated by D. L. Black. (See Plate 2, a). A moderate admission charge is made. Duckweed and water cress adorn the spring-fed streams, where mussels may be found. Cottonwood and sycamore trees shade the picnic tables and fireplaces. On July 16, 1978, the total discharge, at an elevation of 175 meters, amounted to 8.5 lps.

**Williams Springs (21)** are in Fort Worth, 0.6 kilometer north of the Jacksboro Highway on the east side and close to Lake Worth on Williams Spring Road. They trickle on C. A. Buerger's and Ray McCauley's property. In 1896 the water was piped into several troughs which still exist. A whiskey still and blacksmith shop were located here, and later a summer camp.

On August 29, 1979, 0.05 lps emerged from terrace gravel at its contact with the underlying Goodland limestone. Bulrushes, red and yellow flowered cannas, and water shields grow in the water, and tiny green duckweed plants cover the water in an unused trough. Frogs, damsel flies, and water striders are at home here. Williams Springs are shaded by sycamore, cottonwood, willow, and elm trees and grapevine.

At the Texas Electric Service Company power plant on Eagle Mountain Lake five kilometers east of Azle, a spring (16) formerly flowed. It was recorded as flowing in 1953 from Paluxy sand. According to Mike Greene, power plant superintendent, it has been dry since at least 1965.

**Willow Springs (17)** are on Henrietta Creek two kilometers northwest of Haslett on Glen McFarland's lease. The remains of some old buildings at the springs, built by an early settler, were recently removed. On December 24, 1976, 2.5 lps of fresh water were being produced from Lower Cretaceous limestone. On October 13, 1977, after much dry weather, the flow was 0.70 lps. Coyotes and bobcats frequent the springs.

**Double Springs (13)** are at the original site of Keller, which later moved three kilometers southwest, according to former owners Dutch and Barbara Cooke. A gristmill was once located here. Double Springs were



portrayed on several early maps, including that of Gray in 1885. Now they are in Twin Springs Estates, which are being developed by Red Carpet Realtors. The springs discharged 0.35 lps from Woodbine sand on December 23, 1977, supplying a duck pond.

In 1846 John Hurst and his family built a cabin near where the Precinct Line Road crosses the Trinity River south of Hurst. The homestead was on the northwest side of Hurst Lake, an old abandoned channel of the river. It was at the base of a gravel terrace about 15 meters high, from which numerous springs (11) flowed. The old Leonard or Randol mill was one kilometer south. Hurst and Indian scout Jim Ned often went bear hunting in the nearby woods. Now much of the immediate area has been uprooted by gravel strip-mining operations, and the springs are dry.

**Bird Springs (6)** were at Bird's Fort four kilometers south of Euless. In 1841 William Bird and his family built a blockhouse here on the northeast shore of Callo-way Lake, an old meander channel of the Trinity River. At least one person was killed by Indians when he went to the springs for water. This was probably the first white settlement in Tarrant County. In 1843 the springs were possibly visited by Sam Houston's representatives while negotiating for a treaty with the Tehuacana and other Indians. They were located on the slope of a gravel river terrace, where they flowed copiously. As late as 1953, according to Sergeant, they supplied water to a country club swimming pool, the remains of which may still be seen. The springs are now dry and a windmill well is drawing down the water table at their former site. Much gravel strip mining is being done in the immediate area. The site is now used by the Arlington Sportsmen's Club as a hunting camp. A historical marker is located here.

The Guasco village encountered by Moscoso in 1542 may have been on Village Creek between Fort Worth and Arlington. In the early nineteenth century the remnants of several agricultural tribes lived on Village Creek between Handley and the Trinity River. In 1841, while most of the men were away on a buffalo hunt, General Edward Tarrant destroyed the villages, and ordered that no prisoners be taken, massacring many women and children. This "great victory" is boasted of in a historical marker on Highway 303. Most of the surviving Indians moved to more friendly surroundings in Oklahoma. Until this time they had made good use of **Village Springs (10)**.

Village Creek flows along the contact between the Grayson clay on the northwest and the Woodbine sand on the southeast. As the Woodbine is a much better

carrier of water than the Grayson, all of the larger springs were on the southeast side of Village Creek. Village Springs are mostly dry now, but on a western tributary of Rush Creek there is still a flow near Woodland Park Boulevard one kilometer east of Lake Arlington. On July 31, 1978, it amounted to 4.8 lps. It issues from Woodbine sand and gravel which is probably recharged from Lake Arlington. Night herons fish for catfish and other minnows among the cattails.

**Mary le Bone Springs (7)** are about 500 meters south of Arkansas Lane in Arlington, on Mill Creek, sometimes called Johnson Creek. Arista Joyner, an Arlington historian, believes the name should be *Marrow Bone Springs*. Bennett Smith of Fort Worth thinks it is a modification of the French *Mary la Bonne* (Mary the Good) Springs. French explorers are known to have been in the vicinity in the eighteenth century. The springs have also been known as **Mare le Bone, Big Bone, and Fossil Springs**.

In any event, an ancient Indian settlement was located at Mary le Bone Springs, as evidenced by mortars in the sandstone boulders, projectile points, and other relics. Col. Middleton Johnson's Texas Ranger unit was stationed here from 1846 to 1850. In 1949 "several sluggish springs" still seeped from the Woodbine sand on top of a bed of massive sandstone. The land was later dozed and the springs partly buried. On October 13, 1977, there were only standing pools of live water containing frogs in a willow grove. On August 20, 1980, the writer and Velma found the springs very dry. A historical marker stands at the site, in a city park. The location of many former springs is still marked by patches of very black soils.

Springs also existed upstream on Mill Creek, 1.5 kilometers south, at Johnson's Station. They were on the present J. T. Swafford's property. Middleton Johnson operated a trading post and stage stand here in the 1840s. Later a whiskey still was located here. The site, dry since at least 1918, is marked by a grove of black-jack oaks.

In early settlement days the community of **Tate Springs** grew up about 15 kilometers southeast of Fort Worth. It was named for the springs (9) around which it was built. The springs were near the intersection of Little and Tate Springs Roads. They trickled from Woodbine sand, but are reported not to have flowed for at least 50 years. Water still stands in pools in the creek, however.

A possible second group of **Cold Springs (14)** may be on Wildcat Branch near the intersection of Berry Street and Highway 820 in southeast Fort Worth. The



*Mary le Bone Springs.*

Cold Springs church was shown to be located here on a 1920 soils map. The remains are near the intersection of Cravens and Dowdell Roads. Many residents of the area reportedly obtained water from these springs. The springs may have been called Cold Springs. Or perhaps the church was once located at Cold Springs (2) in north Fort Worth, was named for them, and retained its name when it moved to this location. No one now living seems to know.

On December 23, 1977, these springs were producing 0.13 lps from Woodbine sand on Grayson clay. On September 24, 1978, the flow was 0.25 lps, which disappeared before reaching Lake Arlington. Marsh purslane thrives in the pools where minnows dart, shaded by trees. Much trash has been dumped here.

In 1860 Julian Feild built a water-powered gristmill on Walnut Creek at Mansfield. The remains may still be seen just west of Highway 287 and south of the Southern Pacific Railway. The springs (8) from which Feild obtained his drinking water flowed from the Woodbine sand adjacent to the mill. They have now dried up

because of a falling water table.

**Terrell Springs (1)**, in the Botanic Garden in Fort Worth, discharged 0.06 liter per second in 1975 from Kiamichi sandstone. These are believed to have been the campsite of the first white men to arrive in Fort Worth in 1843. They were Captain Ed Terrell, John Lusk, and a Mr. Shackwith, who traded beads and trinkets to the Indians for buffalo robes, and other pelts. Beginning to build a fort, they were captured by Indians and held for about one year before making their escape.

Other springs (3), across the Trinity River from Terrell Springs, are at the foot of Cooper Street. This is believed by some historians to have been the campsite in a live oak grove of Terrell, Lusk, and Shackwith, rather than Terrell Springs. Issuing from Fort Worth limestone, they trickled 1.0 lps in 1975.

**Roaring Springs (15)** are on Indian Creek in Roaring Park in Westover Hills, west of Fort Worth. They apparently have decreased considerably from their former discharge, and no longer "roar." Now there are

numerous seeps from Duck Creek and Kiamichi limestones which dry up in summer.

### TERRELL COUNTY

The size of the springs of Terrell County ranges from comparatively large along the Pecos River to very small in the south. Because of the geologic structure, springs are very rare in the western part of the county. In nearly all cases the water flows from the Edwards and associated limestones.

At most of the well-watered spots in the county have been found an abundance of stone and bone artifacts, fiber products such as baskets and sandals, bedrock mortars, pictographs, and petroglyphs. Obviously the springs were in use thousands of years before Columbus' voyages. When the first explorers, such as De Sosa in 1590, traversed the county, they also depended heavily on the spring water for men and animals.

The springs along the Pecos River have a distinctive flora and fauna. Red cut-leaf penstemon blossoms lend color to the surroundings. Animals such as the red-eared turtle, mottled rock rattlesnake, green heron, and Yuma bat make their home here.

The recharge for the moderately large springs near the Pecos River is believed to take place in the area southeast of Fort Stockton along the drainage areas of Six Shooter and Escondido Draws. This area is some 80 to 110 kilometers northwest of the springs, and around 350 meters higher. Here the streamflow enters the Edwards and associated limestones either directly or through the overlying sand and gravel. It moves down the dip of the formation (southeast) through the cavernous limestone. As the limestone is confined above by impervious beds such as the Grayson shale, the water cannot emerge as springs until it reaches the outcrop of the Edwards near the Pecos River. Naturally any heavy pumping in or to the southeast of the recharge area will cause the springs to decline and possibly dry up.

Although the larger springs still flow remarkably well, many of the smaller springs in the southern part of the county have dried up in recent years. These smaller springs usually have small recharge areas. The cause of their failure is believed to be primarily overgrazing, destruction of the natural grass cover on the land, and its replacement with shrubs such as creosotebush and catclaw. The loss of the thick grasses and their organic mulch has reduced the capacity of the soils to absorb water and transmit it to the underground reservoir, and the shrubs use more water than the former grasses did.

The quality of the spring waters, as may be seen in

the table of Selected Chemical Analyses, is generally good. The water is usually of a calcium bicarbonate type, and is fresh, very hard, and alkaline. Some springs, such as Sulphur Springs, are moderately saline. The writer's chief visit to the county was on September 12-20, 1976.

**Seminole Springs (21)** are six kilometers north-west of Sanderson in Wood Canyon. These are on Mrs. Charles and Leslie Downie's ranch, leased by Bill Rose. An Indian camp was located here, and the springs were also much used by early pioneers. Now there are only some pools of water seeping from lower Cretaceous limestone. A floodwater retarding dam has been built downstream from the springs.

On O. T. Sudduth's ranch four kilometers west-northwest of Sanderson are some very similar springs (24). On June 26, 1979, there were pools of live water here containing tadpoles. After heavy rains in 1974, the springs produced a running stream in which children played for about five weeks, according to Judge Charles Stavley. Live oak, walnut, and cedar trees and algerita shrubs shade the springs.

**King Springs (13)** were 22 kilometers north of Dryden on land leased by Gilbert Bell, at latitude 30°14' and longitude 102°11'. They were on the north side of Downie Draw, which becomes Meyers Canyon a short distance to the east. The springs were shown on several old maps and were much used by the Army. Lt. Nathaniel Michler stopped here in 1850 (U.S. Senate, 1850) while exploring routes to the West. In 1885 the remains of an abandoned Indian village could still be seen here, according to historian Clayton Williams of Fort Stockton. A 1918 geological report indicated the springs were then still flowing. They are dry now, but marked by a growth of large cedars and algeritas. Some tinajas in the rock still provide water for stock. These springs should not be confused with King Springs (36) about 63 kilometers northwest in Pecos County.

About 11 kilometers north of Dryden is Sorcerer's Cave on Eight Mile Draw. This is the deepest known cave in Texas (167 meters). It also contains the longest stalactite in Texas (7.05 meters). At the bottom is the Sirion River, whose flow on October 21, 1978, was estimated to be 250 liters per second. This underground river, which flows in Fort Terrett (Edwards) limestone, probably is the source of springs along the Rio Grande to the south and southeast. Perhaps further exploration of the cave will reveal where the Sirion River reaches the surface.

Many springs burst from the limestone at the mouth of Independence Creek. About 25 kilometers south-southeast of Sheffield are **T5 Springs (2)** on the Oasis



Ranch. They break forth at the foot of a hill at an elevation of 610 meters four kilometers east of Highway 1217. University of Texas studies have enumerated 27 species of fish which live in the spring waters. Discharge measurements in lps are:

1917	160	Feb. 7, 1968	250
Jul. 25, 1929	240	Sep. 13, 1976	60
Mar. 29, 1962	370		

**Vanderbeek Springs (3)** are five kilometers west of T5 Springs. The many springs were flowing about 52 lps from cobbles and gravel on September 13, 1976. A grove of cedars, willows, and live oaks surrounds them. Independence Creek received its name from the fact that a colony of slaves were working on the creek when the Emancipation Proclamation was issued. These springs, as well as T5 Springs, have been used for irrigation, and were shown on several old maps.

**Chandler Springs (1)** are at the mouth of Independence Creek, on the north side. Some, flowing 7.2 lps, are at Joe Chandler's headquarters. Another group, which yields 6.5 lps, is about one kilometer east at the old Chandler ranch house. These waters are impounded and used to irrigate a golf course. Numerous live oaks, rare this far west, are present. Nearby are many bedrock mortars, burned-rock middens, and caves containing artifacts left by the original residents.

Two kilometers southwest of the mouth of Independence Creek, on land leased by Hugh Harris, are **Sulphur Springs (5)**. These springs have built up a mound of travertine and siliceous sinter 200 meters in diameter and four meters high on the Pecos River floodplain. At the top of the mound are two holes, each two meters in diameter and about one meter deep. The warm (29° Celsius) water bubbles up from these holes, flowing off at the rate of 0.18 lps. Containing much sodium sulfate and chloride, it is still used for baths and internal consumption, and is believed to be beneficial to health. These springs are the farthest southeast (down dip) of this group of springs. This results in a very slow circulation of water through them, and is probably the cause of their high mineralization. A large roost of vultures make their home in a nearby tree.

Near the mouth of Richland Canyon seven kilometers east of Sulphur springs, on land operated by Cy Banner, is another group of important springs. **Richland Springs (8)** rise in a cluster of live oaks 580 meters above sea level, forming Richland Creek and flowing one kilometer to the Pecos River. Granger (1878) depicted them as **Martin Springs** on his map. At Goode Cave nearby numerous stone artifacts, bone tools, ocher, and grinding stones have been found.

Discharge measurements in lps include:

1917	93	Feb. 7, 1968	54
Jul. 25, 1929	79	Sep. 14, 1976	170
Mar. 29, 1962	110		

About one kilometer east **Wolf Springs (7)** break out from limestone at the foot of a bluff on the north side of the creek. They feed several former fishing lakes and have been used for irrigation. The grounds are beautifully kept up, with many waterfalls and live oaks. (See Plate 12, a). Discharge records follow:

1917	93	Feb. 7, 1968	180
Jul. 25, 1929	180	Sep. 14, 1976	80
Mar. 29, 1962	180		

Ten kilometers farther southwest, at the mouth of Geddis Canyon, is another group of moderately large springs, on Herbert Brown's land. About five kilometers from the mouth **Packingham Springs (4)** issue from the base of a bluff on the south side of the creek and flow about 200 meters before sinking into the gravel. A cluster of willow, live oak, and fig trees, with rattlesnakes, is found here. The discharge was 84 lps on Sep. 14, 1976.

Two and a half kilometers from the canyon mouth are **Geddes Springs (6)**, named for a Lt. Geddes but now often spelled Geddis. They were shown on W. R. Shafter's 1877 *Map of parts of Texas, Mexico, and New Mexico*. They include a large group of springs, some issuing below the water surface in Geddes Creek, which flow for 150 meters before disappearing. The discharge was estimated to be 160 lps in 1917 by Christner and Wheeler (1918), probably including Packingham Springs. On Apr. 29, 1943 it was 74 lps, and on Sep. 14, 1976 it was 65.

In the canyon wall nearby is a small shelter containing pictographs (Kirkland and Newcomb, 1967). **Julius Springs** are another important group about 5 kilometers northeast of Geddes Springs.

**Sweetwater Springs (16)** are about two kilometers north of the mouth of Geddes Canyon, on Cy Banner's ranch. Here a large number of springs break forth from limestone at the base of a bluff at an elevation of 580 meters. They were depicted as **Arocha Springs** on Spaight's 1882 and Rand McNally's 1885 maps. The water was formerly impounded in a fishing lake surrounded by live oaks and hackberries, but the dam has failed. The discharge records in lps are:

1917	130	Feb. 7, 1968	69
Apr. 29, 1943	91	Sep. 14, 1976	100
Mar. 29, 1962	79		

Seventeen kilometers northeast of Dryden are **Meyers or Painted Rock Springs (20)**, probably the

best known springs in the county. They are in Meyers Canyon on a ranch operated by Olin Smith, at latitude 30°05' and longitude 101°57'. Kirkland and Newcomb (1967) described them well:

... a rock shelter whose walls are covered with "one big panorama of Indian pictographs ... Named Meyers Springs, for the spring which breaks out from the cliff about thirty yards above [upstream from] the shelter, this oasis has long been used by men ...

The back of the shelter is one continuous buff-colored limestone wall slightly curved but smooth to a height of about twelve feet and protected by overhanging rock for a distance of about seventy-five yards ... The stream runs under the shelter with only a small table of rock between it and the back wall. This table or rock contains more than a dozen large mortar holes. On the hill in front of the shelter are two large burned-rock mounds and other mortars.

Some of the Meyers Springs paintings may be several thousand years old, while others, showing horses, wagons, churches, and firearms, are obviously of historic age. (See Plate 5, c). W. H. Emory, surveying the United States-Mexico Boundary in 1857, camped here en route from Pecos Springs to the Rio Grande. In 1879 Burr Duval visited the springs, commenting:

Meyer's Springs is cool and can boast of some shade trees. A high over-arching cliff of white limestone with a clear pool of water at its base is the attractive feature of the place. On the face of the cliff are numerous Indian picture-writings in red ochre. I noticed that the figures of the men all bore bows and arrows except in one instance where the warrior appeared armed with a flintlock musket. It struck me as rather singular and suggestive that in all these "picture writings" and others that I have seen, there nowhere appears anything obscene. Give the cultured Saxon a piece of red chalk and tell him to draw something and the chances are ten to one it will be a nasty figure or an obscene idea expressed somehow. So much for our boasted civilization! This has been a general camping place for troops for some years, and the vandals have obliterated in many instances the choicest of the "picture writings" by inscribing their own obscure names over the face of rock in black paint. Confound the stupid idiots, and their stupid officers who permitted such vandalism. I noticed my own name, "Duval" in large, black letters on the most prominent part of the cliff and mentally consigned the owner of it, (who it seems was "private in Company B") to a hotter place than I care to mention.

Unfortunately the destruction of the priceless paintings at Meyers Springs continues today. Many so-called sportsmen have used them for target practice, resulting in enormous damage.

An Army post was located here as early as 1882. In 1901 a rock-walled pool was constructed by Major John Bullis. The water emerges from a hole in the cliff and falls about four meters into the pool.

According to Smith, Meyers Springs now flow only intermittently. On September 15, 1976, after rains, the discharge was 1.1 lps. Surrounded by live oak and black persimmon trees, the springs and tinajas form a haven for numerous deer, javelinas, and ducks.

Twelve kilometers west-northwest of Pumpville and one north of Malvado station are **Cedar Springs (22)**, on Lena Mae Bricker's and Dora Dingler's ranch. They are located in Cedar Draw, close to the point where Thurston and Meyers Canyons join to form Lozier Canyon. The springs were obviously home to an ancient people. Nearby are pictographs in a rock shelter, bedrock mortar holes, and burned-rock middens.

Cedar Springs issue from upper Cretaceous Buda limestone. On June 27, 1979, there was a pool of live water five meters in diameter containing many tadpoles. The channel has been largely filled with gravel and cobbles. Water usually flows under these deposits. Around the springs are orange-berried granjeno and algerita bushes, candelilla plants, and pink-barked madrone, black persimmon, and cedar trees. Small hawks soar overhead.

The similar **Outlaw Springs** are five kilometers north, off Sevenmile Canyon. **Lozier Springs** were shown on some old maps in this vicinity.

**Craig Springs (23)** are farther down Lozier Canyon, six kilometers west-southwest of Pumpville, on Andy and Annie Lou White's ranch. A prehistoric people who lived in rock shelters here left burned-rock middens and bedrock mortar holes, the latter recently destroyed by floods. Craig Springs were shown on Greene, Johnston, and Butterfield's 1880 *Map of the new road from Fort Clark to Fort Davis, Texas*. The Rock Pen ranch was located here around 1900.

Craig Springs are now wet-weather seeps. One feeds a pool five meters in diameter containing tadpoles. The other drips from Buda limestone ledges. Raccoon tracks are numerous. A windmill saps the underground water supply. Several other very small springs still seep a few kilometers upstream in Lozier Canyon.

Twenty-seven kilometers southeast of Dryden, on Cedar Creek on the Eastman ranch (now leased by C. A. McFadden), were another **Cedar Springs (15)** at latitude 29°54' and longitude 101°54'. Very important to early settlers, the springs are now dry, but 0.35 lps was flowing in Cedar Creek from other small springs in Austin chalk upstream. On a hill 300 meters southeast is the grave of an early resident, Mrs. Z. J. Franks, who died in 1885. Wild mustangs were once corralled at the springs. A large willow tree still stands at the site.

Eighteen kilometers southeast of Dryden, on Dudley

Harrison's land, are **Buena (Good) Springs (11)**. Located close to Buena Creek, they are at latitude 29°53' and longitude 102°00'. In 1976 the water issued from numerous seeps in Buda limestone at about 0.10 lps, flowed into the gravel in Buena Creek, and disappeared. Severe overgrazing in this area in the past has reduced the ground cover largely to creosotebush, catclaw, and mesquite, seriously impairing groundwater recharge and streamflow.

About 2½ kilometers west of Buena Springs are **Blue Water Hole Springs (10)**, named for the hole in the rock in the adjacent Indian Creek. The water flowed from Buda limestone at about 1.6 lps in 1976, precipitating much travertine which has formed many small dams between the springs and Indian Creek. The springs were dry during the droughts of the 1930s and 1950s. Frogs are very numerous in the waters here, as are ducks, raccoons, and javelinas. Willows and rabbit-brush surround the springs.

Two kilometers northwest of the Blue Water Hotel are **Indian Springs (9)**, the source of Indian Creek, at the old Johnson ranch house. They also flow from Buda limestone, at about 3.1 lps in 1976. The water disappears and reappears in gravel beds in the creek, and then apparently enters a limestone conglomerate which crops out across the creek at Blue Water Hole Springs. A grove of willows flourishes in the spring flow. In 1736 Captain Miguel de la Garza Falcon explored from Del Rio to this vicinity. In the words of Castaneda (1936):

... they came to a place where many wild grapevines were growing, for which reason they called it Parral. A strong norther was still blowing and it was snowing, but they went on seven leagues beyond to a deep ravine surrounded by hills. This must have been either Indian Creek or Canyon, south of Dryden. On one of the hills they found a large wooden cross standing [probably erected by Joseph Berroteran seven years previously], and called it La Santa Cruz de Mayo, their benumbed bodies bringing to them perhaps memories of sunny May. The next day they decided to turn back.

Nine kilometers southwest of Dryden, on the late Col. Clifford Hunn's ranch, were **Indian Wells** or **Indian Pot Hole Springs (14)**. At the head of McClain Canyon, they were at latitude 29°59' and longitude 102°09'. W. R. Livermore depicted them on his 1883 *Military map of the Rio Grande frontier*. Here a large water-filled hole has been scoured out of Buda limestone by floodwaters. In shelters around the edge of the pool were Indian paintings, now almost all gone. A few mortars are located in the rock above the pool. Although dry at the time of the writer's visit, the springs



*Indian Pot-hole Springs.*

are reported still to flow in wet weather. A flock of egrets frequent the vicinity.

**Chupadera (Seep) or Luis Guerra Springs (12)** were 18 kilometers southwest of Dryden at the head of Red House Canyon, at latitude 29°56' and longitude 102°14'. Although they are now only seeps, Robert Gatlin, the owner and a long-time resident here, remembers when these and other nearby small springs flowed all winter each year, providing water for about 1.6 kilometers down the canyon. He charges overgrazing and destruction of the natural vegetation with the failure of these springs. Former users of the springs left many artifacts, mounds, and paintings. Panthers and javelinas are still common here.

A large number of springs flow along the Rio Grande in the Lower Canyons. This is the reach from Boquillas to Amistad Reservoir. The low flow of the Rio Grande is roughly doubled by spring flow in this reach.

Practically the only way to see the springs in this pristine area is by boat. Several outfitters in Terlingua, Lajitas, and Alpine conduct float trips, which usually put in at La Linda just east of Big Bend National Park and take out at Dudley Harrison's camp south of Dryden.

Near the springs may often be seen mortar holes in the bedrock. This almost inaccessible area supports a rare biotic community. It is the only known location for the delicate, pink Maravillas milkwort and the tiny heather leafflower. The spring-fed streams are the lifeblood of the mountain lion, zone-tailed hawk, the highly endangered peregrine falcon, and the rare pocketed freetail bat.

**Chupadera or Dripping Springs (25)** are in a cove at the mouth of Washboard Canyon at the Brewster County line. Ferns and mosses surround the seeps, and a beehive is nearby. The springs are on Tommy Hayre's lease.

**Panther Springs (26)** are five kilometers east of



the Brewster County line on the Rio Grande. They are a favorite watering stop for rafters. On June 29, 1979, the discharge of warm (35°C) water from the Georgetown limestone was about 13 lps.

## TERRY COUNTY

The springs of Terry County issue primarily from Ogallala sand and caliche. Groundwater moves through this formation toward the southeast at about 50 meters per year. Some springs also issue from Tahoka sand (old lake deposits) around the larger lakes.

There are two Lost Draws in the county, both of which get "lost" before reaching any major river or stream. In the northern part of the county is North Lost Draw, which drains into Rich Lake. South Lost Draw flows through Brownfield and eventually disappears in southwestern Lynn County.

About 18,000 years ago this area received 125 centimeters of precipitation annually and supported conifer forests. In this setting Paleo-Indians camped by springs while hunting mammoths, saber-tooth tigers, huge bison, and other now-extinct animals. Many living sites of these early Americans have been found, especially near the springs around the larger lakes.

Groundwater levels have fallen greatly since irrigation pumping began in the 1930s. From 1937 to 1967 the water level declined more than 6 meters in places. Pumping of groundwater for irrigation reached a maximum in 1964, when 0.204 cubic kilometer was discharged. This has been the major cause of the failure of the county's springs.

The springs and spring-fed creeks and lakes harbored a complex ecosystem. Willow and cottonwood trees shaded pools where cattails, ferns, milfoil, and water cress grew. Fish, frogs, snakes, lizards, crawfish, and water insects thrived in this environment, along with the larger animals which preyed upon them. Ducks, geese, cranes, herons, and many other waterfowl found refuge on the lakes, which were usually brimful. When most of the springs, creeks and lakes dried up except for occasional storm runoff, the majority of these plants and animals disappeared.

The remaining spring waters are generally of a sodium sulfate type, moderately saline, very hard, and alkaline. The content of silica and fluoride is usually high.

Most of the writer's field studies were made during the period October 22-27, 1978.

Three kilometers east of Tokio on Reg Martin's ranch is a seep-fed caliche pit (8). A natural seep-fed

lake once existed here. Many projectile points found in the vicinity indicate that this was a favorite haunt of prehistoric people. The old J Cross ranch was later located here. The water in the pit is fed by seepage from Ogallala caliche on Duck Creek sandstone, maintaining a constant level about five meters below the surrounding surface. According to Martin, the water level in the pool is about 0.3 meter higher at night than during the day in summer. This probably results from less evaporation and transpiration by plants at night. Great bulrushes and pink-flowered smartweed fringe the pool, where catfish and water dogs live.

Seven kilometers north of Johnson is a large dry lake on Robert Beasley's ranch. That the lake was once permanent and fed by seeps (3) is evidenced by burned-rock middens and projectile points of an ancient people who lived on the east side. The Ogallala sand and caliche from which the seeps flowed was recharged by water sinking into the sand dunes to the north. The lake bed, now in pasture, is home to many prairie dogs and hawks.

Four kilometers farther north, on Ethel Solsbery's and Royce Terry's ranches, there is evidence of very small springs (4) in the past along Sulphur Draw. Early Americans lived here thousands of years ago, as disclosed by caches of flint cores, projectile points, manos, and metates found in the adjacent sand dunes. In the early 1900s many catfish could still be caught in Sulphur Draw, according to Mrs. Solsbery. Now the draw is largely in cultivation, and the channel is filled.

Springs (7) ran continuously in North Lost Draw northwest of Needmore until around 1900, according to O. R. Watkins, well-known Levelland historian. When he came to this vicinity in 1925, the creek still ran from spring flow occasionally for a few weeks at a time. Now the channel has been filled with sediment and the draw is all cultivated.

Four kilometers north-northwest of Needmore is a dry lake on Robert Beasley's property. Burned-rock middens and flint projectile points and tools found all around this lake bed testify that it was once an important living area. At that time the lake was no doubt maintained by seeps (5) from Ogallala sand and sand dunes. Now the lake bed is in pasture. A few sandhill cranes still stop at a small excavated pool of surface water in the middle.

At Rich Lake, seven kilometers south-southeast of Meadow, are several springs (6) on Rev. Cletus and Olane Caswell's land. Potsherds and flint points have been found around the lake. **Rich Springs** issue from Tahoka sand on Duck Creek shale. Those at the north

end of the lake reportedly produced about 19 liters per second at the turn of the century. On May 18, 1938, the flow was 0.63 lps. On October 23, 1978, it was 1.2 lps after a four-centimeter rain. The north springs are moderately saline (see table of Selected Chemical Analyses). The south springs, slightly larger, are very saline and cannot be used by cattle. Many other very small springs flow around the lake.

On October 23, 1978, the lake basin was about 90 percent covered with water. According to Rev. Caswell, the lake rises before rains, indicating that the springs and lake are affected by changes in barometric pressure. Ozark-Mahoning Co. mines sodium sulfate here by a solution process. Cattails and salt cedar are abundant. Algae and brine shrimp inhabit the lake. Sandhill cranes roost in the lake at night, feeding in grain fields by day.

Mound Lake, 17 kilometers east-northeast of Brownfield, is fed by many springs (1). Most of the lake is on James Roberts' ranch. The largest **Mound Springs**, at the south end, produced 4.0 lps of very saline water on December 13, 1975. The figures shown in the table of Selected Chemical Analyses were furnished by Ozark-Mahoning Co., which mines sodium sulfate here. Other springs around the lake are slightly less saline. Cattle drink the water but do not do well on it, according to Roberts.

The spring waters were used for medicinal purposes by Indians and early settlers. Mexican shepherds arrived here in the 1850s. On December 13, 1975, the lake bed was 90 percent covered with water. About 30,000 sandhill cranes were here, on their way from Alaska to South America. The noise of their rattling calls was deafening. Brine shrimp are numerous in the lake. Severe gully erosion is filling the lake with sediment. Many oil wells pump in and around it.

Nine kilometers northwest of Brownfield, near the junction of Sulphur and South Lost Draws, is the T. C. Hogue farm. Here numerous burned-rock middens and flint points have been found. Hogue's father heard of very small springs (9) which once flowed here, but they had disappeared before he arrived in 1917. Now the channels are filled with sediment from plowed land on the adjacent steep slopes, and the draws are cultivated.

Eleven kilometers east-southeast of Brownfield on Crede Gore's land are two caliche pits (10) on South Lost Draw. Fed by seepage, these pits maintain a water level about two meters below the surrounding surface. Thousands of blackbirds and ducks live among the bulrushes, salt cedars, and willows. Nearby a shallow well flowed at the surface in 1977.

Farther downstream, 17 kilometers southeast of Brownfield on South Lost Draw, are Seven Lakes. Here many very small springs and seeps (11) issue from Tahoka sand on clay, chiefly on the north and west sides of the lakes. On October 24, 1978, the lake beds were 90 percent covered with water. Ozark-Mahoning Co. mines sodium sulfate from beneath the lakes. Many flint points and tools and potsherds have been found in the vicinity. According to Sid McIlveen, geologist for Ozark-Mahoning, algal stromatolites and brine shrimp are numerous in the lake brine. Sandhill cranes, as well as less common birds such as avocets and stilts, stop at the lakes. According to M. H. "Jack" Wagner of Brownfield, the springs at the north end of Seven Lakes increase their flow one to three days before a rain. Evidently they are affected by changes in barometric pressure.

Seven kilometers west of New Moore and just south of Highway 213 is a caliche pit (14) on O. D. Line's property on South Lost Draw. Seepage from Ogallala caliche maintained a water level about two meters below the surrounding surface on October 25, 1978. Because the water is moderately saline and cannot be used for irrigation, the water table has not declined much here. It is also possible that water imported from Rich Lake to the Ozark-Mahoning mine upstream has helped to maintain the water level. Brine shrimp are abundant, as are ducks and little green herons. Salt cedar fringes the shores, littered with shotgun shells. The surrounding sand dunes are covered with shinery, yucca, and sand sage.

Five kilometers west of New Moore is a seep-fed lake (2) on South Lost Draw owned by Sam Saleh, Hal Singleton, and Tom Webb. In 1968, according to Don Blair of O'Donnell, there was much rain and the water table rose. A road across the lake was inundated and had to be abandoned. Much land was forced out of



Line Caliche pit.

cultivation as salt cedar and bulrushes spread. Other factors than rainfall, such as man's activities in the upstream watershed, probably contributed to this unusual change. Many ducks and other waterfowl use the saline lake water.

On Sulphur Springs Draw 10 kilometers east-southeast of Wellman is Coke Toliver's farm. Here and elsewhere along the draw are many Indian sites containing burned-rock middens and flint points and tools. Many people have heard of very small springs (13) which flowed through fishing holes here before 1900, but no one now living remembers them. The Spanish explorer De Salas may have stopped here in 1632. The channel is now filled and the draw all cultivated. Wind erosion and blowing sand are a problem.

On Elma Oliver's farm, seven kilometers northwest of Wellman on Sulphur Springs Draw, the water table is still relatively shallow. Here a shallow well flowed until the 1950s, when an irrigation well began pumping nearby.

## TITUS COUNTY

Most of Titus County's springs issue from Tertiary Eocene sands, especially the Queen City, Reklaw, Carrizo, and Wilcox formations, and from Quaternary terrace sands. The water-bearing sands dip toward the southeast at about 10 meters per kilometer.

The springs have been used by early Americans for many millennia. Bill Anderson of Mount Pleasant has found Scottsbluff projectile points left near springs by these ancient people probably 8,000 years ago. At the dawn of historic time the Caddoes built their villages in the county. Later various tribes, forced out of their eastern homes by the white settlers, lived in the county briefly. They included the Choctaws, Quapaws, Cherokees, Kickapoos, Creeks, and Shawnees. Indian artifacts have been found along practically all of the spring-fed streams.

Many natural lakes, teeming with large fish, were formerly fed by springs. Passenger pigeons were so numerous they could be clubbed to death in their roosts. Now the lakes are largely drained or silted up and most of the animals which depended upon the lakes and springs have vanished. In the early days much damage was done to the land and springs by clearing and plowing. There is no cultivated land today in the county, but the scars of former cultivation remain as gullied areas, partially healed and recovered with pine woods.

Many springs still exist in Titus County, but in this book only those of some historical significance have

been included. The spring waters are usually of a calcium or sodium bicarbonate type, quite fresh, soft, and acid. The iron or manganese content is often high.

The writer's field studies were made primarily during the period December 12-17, 1977. As this was a rainy period, the spring flows observed were probably higher than normal for this season.

**Red or Indian Springs (2)** in Dellwood Park on the southeast side of Mount Pleasant were the best known springs in the county. Numerous artifacts found here testify that this was a popular living site for thousands of years. The Caddoes called the springs *Koko Bahat* or Red Water, according to Traylor Russell, a noted historian of Mount Pleasant. In 1840 when they were forced to leave, the Caddoes burned their village here. Some of the old people chose death in their beloved homeland rather than departure, and were burned in their homes.

In 1883 development of Red Springs as a resort area began. In 1892 the Iridescent Springs Development Co. advertised the red, clear, and bluish waters of the various springs and sold hot mineral baths for \$0.50. In 1907 a large hotel was built, with fountains of the various waters in the lobby. The water was sold in bottles and transported around town. It was claimed to cure gout, arthritis, rheumatism, tuberculosis, constipation, piles, nervous derangement, and kidney and bladder ailments. In 1910 a mule car transported guests on wooden rails from town to the hotel. In 1912 the hotel closed, but was operated for two more years as a prep school. In 1925 it burned. The springs no longer flow, but are contained in a covered brick tank three meters in diameter.

In west Mount Pleasant near the Edwards cemetery at the intersection of Edwards and West First Streets are **Yankee Springs (1)**. Here a detachment of Union cavalry camped from 1865 to 1870 while enforcing the Reconstruction laws. The springs flowed 0.17 liter per second from Wilcox sand in 1977. A short distance downstream on Town Branch Benjamin Gooch built the first house in Mount Pleasant around 1840.

Five kilometers east-southeast of Winfield and just east of White Oak Springs cemetery are **White Oak Springs (3)**. According to John Hollingsworth, who lives nearby, a community grew up here in the 1850s. Starting in the 1870s the White Oak Springs academy and church used the water. The church still does. In 1942 the flow was 0.19 lps and in 1977, after rains, 0.33. The springs appear at the base of a white oak tree in a mixed wood just east of the church. Another spring formerly flowed from a large concrete pipe section just upstream, but is now dry. Four kilometers southwest



are the Hale mounds, built by a prehistoric people.

Two kilometers north of Winfield, on Charles Black's land, are **Ripley Springs (10)**. They were a favorite living area of early Americans for thousands of years and are marked by many Indian graves and artifacts. When Ambrose Ripley and his family moved here in the early 1830s, trouble began. The Choctaws, resentful of being forced to move once again, killed eight members of the family in 1841. In 1977 many springs discharged 0.92 lps from bluffs of thick Wilcox sand. Other springs upstream on Ripley Creek produced 1.4 lps at this point in 1977.

**Marshall Springs (9)** are eight kilometers north-northeast of Winfield and just north of Marshall Springs cemetery. They were used by early settlers who reached this area in the 1870s. In 1977 they discharged 0.20 lps from Wilcox sand on top of Midway clay in some woods. About two kilometers south-southwest are similar springs at West New Hope church, which were also very popular in early days.

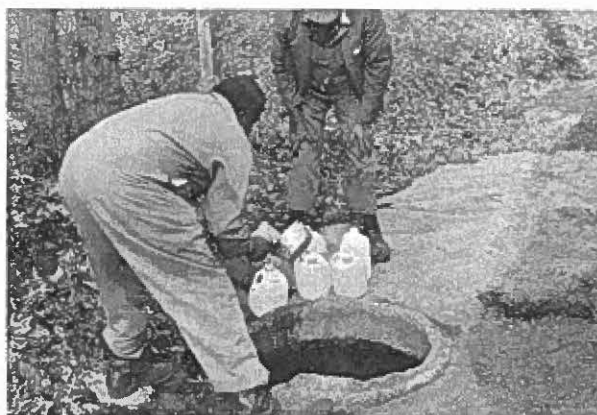
**Maple Springs (8)** are four kilometers west of Wilkinson on Gene Goates' land. A school was formerly located nearby. Now there are only seeps from a wooden box, and the maple trees are gone. The water issues from Wilcox sand in the Talco fault zone. A domestic well here has probably reduced the spring flow.

**Spring Hill Springs (6)** are eight kilometers south of Wilkinson and just north of Spring Hill cemetery. A community grew up around the springs, and people came from the surrounding countryside to wash clothes. A cattle dipping vat was located here. The iron-bearing water ran 0.05 lps in a pasture in 1977.

Eight kilometers east-southeast of Wilkinson on Highway 71 are **Dundas Springs (7)**. In 1942 they discharged 0.063 lps, but are now only weak seeps. They issue from Wilcox sand in the Talco fault zone, in an area characterized by "pimple mounds." The district has been much disturbed by oil-well drilling. Nearby there was formerly a salt seep called **Red Lick**, much used by animals in early historic times.

**Simmons Springs (5)** are one kilometer north-west of Argo on Bill Anderson's farm. During the race riots of the 1890s the colored son of Gary Simmons was shot and killed while drinking at these springs, according to Traylor Russell. In 1977, 0.53 lps issued from Wilcox sand. A grove of willow and other trees surrounds the springs, whose water flows over a small dam.

**Oak Grove Springs (17)** are eight kilometers north-northeast of Mount Pleasant, on a road in the Oak Grove community. They were used by soldiers



*Oak Grove Springs.*

during the Civil War, according to nearby resident A. E. Kittle. The main spring issues from a large concrete pipe section on the old Porter place, where a fence has been relocated to make it accessible from the road. Formerly it flowed from a hollow sweetgum log. Many people still stop here to fill water jugs. In 1963 the discharge was 0.41 lps and in 1977 it was 0.15. Several other springs nearby, including one on Kittle's place, brought the total flow to 1.0 lps in 1977.

**Moore Springs (16)** were in east Mount Pleasant, probably in a wooded draw near the intersection of East Eighth and Cecilia Streets. In 1846 Burrell Moore had these springs walled up. They no longer flow, probably because many wells in the vicinity have drawn down the water table. About two kilometers south are some Indian mounds on Carl Denman's farm.

**Gooch Springs (14)** are 11 kilometers east-south-east of Mount Pleasant, close to Welsh Reservoir and on the property of the Welsh Power Co. This was a very popular spot with prehistoric Americans, as indicated by the many artifacts found here. The Caddoes called the creek (now inundated here by the reservoir) *Swanano* or Good Water. Around 1840 Benjamin Gooch and his wife settled here. The springs have been much used for picnics, swimming, and political speeches. They are reported to have maintained a strong flow even in droughts when all other springs in the area dried up. In 1977 they flowed from Reklaw sand in a bluff through a concrete box into a small pond, at 0.57 lps. Beavers have built a small dam to raise the pond outlet. Other similar springs are nearby. At one about two kilometers northwest Kendall Lewis and his Choctaw wife lived in 1835.

Eight kilometers northwest of Cason, northwest of the Snodgrass cemetery, are **Snodgrass Springs (13)**. Here David Snodgrass and his wife built a cabin in 1849. In the early 1890s Carrick Snodgrass dug up a

bucket containing \$20,000 in gold which his deceased parents had buried near the springs. Other heirs contested his action and a long court battle ensued. On December 15, 1977, these and other springs produced a discharge of 3.2 lps from Reklaw sand on upper Williamson Creek. The springs are in a wood where much iron strip mining has taken place.

**Hickory Hill Springs (12)** are five kilometers northwest of Cason at the Hickory Hill church. They flow from Reklaw sand amid huge hickory trees. In 1963 they produced 0.25 lps and in 1977, after rains, 1.1.

A second **Spring Hill Springs (11)** are five kilometers west of Cason, west of Spring Hill church and cemetery. A shallow well which supplies the church and a house has reduced the iron-bearing spring flow to seeps from Queen City sand. Pools of live water in the woods are fringed with pennywort and ferns. Former gullies nearby are partially healed and overgrown by woods.

South-southwest of Mount Pleasant, on the property of the M. J. Priefert Co., which manufactures ranch equipment, are **Priefert Springs (15)**. An Indian campground existed on an adjacent knoll. Three groups of springs poured from Wilcox sand at an elevation of about 105 meters on December 16, 1977, producing, from north to south, 5.5, 2.1, and 2.0 lps. A large swamp, now reduced to about 8 hectares by draining, once existed here. The largest springs are in the upper of two lakes, where large bass, perch, and catfish thrive. The others produce pools in a pasture, bordered with water pennywort and swamp grass. During the drought of the 1950s, and also in 1972, the American Liberty Oil Co. refinery pumped water from the springs. In the 1950s the city of Mount Pleasant also used the water.

Thirteen kilometers west-northwest of Pittsburg, on Jim McBride's place, is an old log cabin called Fort Sherman. In the wooded Bells Branch just south are **Sherman Springs (4)**. That these springs were long the homesite of prehistoric people is indicated by the abundant pottery and other artifacts found here. In 1839 Capt. William Stout's company forced the Indians to leave the springs. In 1977 0.75 lps poured from Wilcox sand.

## TRAVIS COUNTY

Travis County is very rich in prehistoric artifacts. There is no doubt that early Americans lived in this area at least 11,000 years, and probably much longer. They were drawn to the area by its abundant springs, many

of which had ready-made homes in the form of rock shelters nearby. And of course where there was plenty of water, there was also a rich supply of game, fish, fruit, and nuts.

The largest of Travis County's springs burst from the Edwards and associated limestones along the Balcones fault zone, which bisects the county, running south-southwest to north-northeast. Impervious rocks such as the Eagle Ford shale have been faulted down on the east side of the zone to form underground barriers, forcing the water in the cavernous limestones on the west to the surface. Other springs pour from Upper Cretaceous Austin chalk, Lower Cretaceous Hensel sand and Glen Rose limestone, and Quaternary river terrace sand and gravel.

As Austin is well supplied with water from the Highland Lakes on the Colorado River, heavy pumping of groundwater has not been necessary. Nevertheless some springs have failed because of declining water tables. Still, springs are very numerous, and only those of some importance are included here.

A number of rare and endangered species of plants and animals live in the springs environment. These include the Texas alligator lizard, the white and yellow flowered anemone, and the earthstar fungus, found only in central Texas and Japan.

Underground caverns are numerous along the Balcones fault zone where the limestone rock formations have been displaced. These caverns usually represent passages through which water formerly flowed, which were enlarged by the solution and removal of much limestone and gypsum. In these caves and their associated springs live several unusual species of crayfish, snails, and flatworms, according to Lundelius and Slaughter (1971). As they can live nowhere else, it is important to preserve the springs so as not to destroy these species.

The spring waters of the county are usually of a calcium bicarbonate type, fresh, very hard, alkaline, and high in silica. They may also be high in sulfate. Natural petroleum and asphalt have been reported in springs in northern Travis County.

The writer's field studies were made chiefly in 1972 and 1973, during a groundwater study of the county for the Texas Water Development Board, and at numerous times since.

Most of Travis County's more important springs are located in or near Austin. **Barton Springs (5)**, three kilometers southwest in Zilker Park, are by far the largest in the county. They are the fourth largest in Texas, being exceeded only by Comal, San Marcos, and San Felipe Springs. They were sometimes called

**Zilker Springs** in the past.

Issuing through a fault in the Edwards and associated limestones, they are part of a chain of large artesian springs extending from Del Rio to Belton in the Balcones fault zone. They are recharged chiefly by surface water in Barton Creek, and to some extent Onion Creek, which enters the aquifer where a number of large faults or displacements of the rock strata cross the creeks from 1 to 25 kilometers west and southwest. From there most of the water flows in a few days to a month through underground channels and caverns to the springs. Most of it originates in Hays County (Guyton and Associates, 1958). The springs emerge at an elevation of around 135 meters. Naturally there are no springs in the recharge area as the surface water here moves downward into the aquifer.

An old Comanche Indian trail from Bandera County to Nacogdoches passed Barton Springs. They were a

popular gathering place for Tonkawa, Apache, and Comanche Indians in historic times, and probably for their ancestors for thousands of years previously. Spanish explorers wrote that in 1714 wild horses were numerous here. Three Spanish missions were located at the springs from 1730 to 1731. In 1839 the five commissioners named to select a site for the capital of Texas described the springs as "perhaps the greatest and most convenient water power to be found in the Republic." Bonnell (1840) described them as "large springs, many of which would afford 5 or 6 hundred barrels of water a minute [1,300 to 1,600 liters per second], ... bursting out at the foot of the mountains."

In 1837 William Barton settled at the springs, naming two of them for his daughters. In the same year W. C. Walsh and Henry Steussy built a gristmill. Later a number of saw, flour, and gristmills and an ice-making machine used the water power of the springs. A stage

*Barton Springs.*





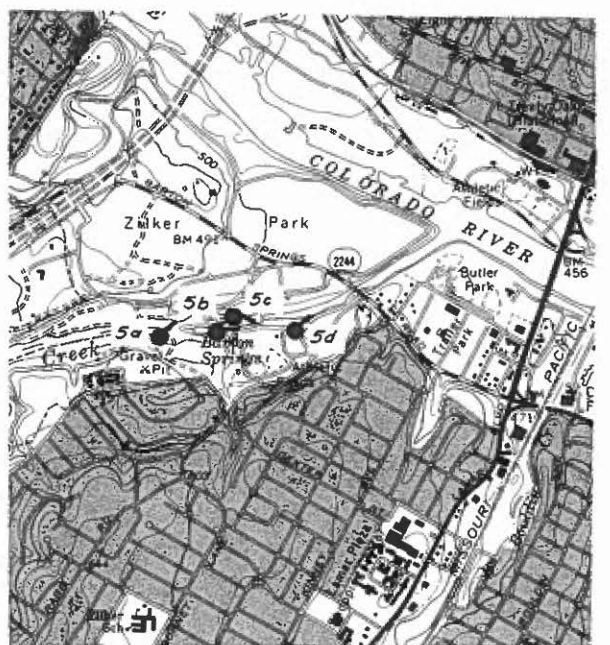
stand and ferry on the north-south highway were established here. About 1875 the riverboat "Sunbeam" was running excursions from Austin to Barton Springs for \$0.50. Historical markers commemorate some of these events.

The springs have always been very popular for swimming. In the summer of 1978, 421,000 people paid to enter the Barton Springs pool area, and many more used the facilities during periods when there was no charge. In 1884 there were complaints about nude bathers. Now many topless female bathers frequent the spot. History is repeating itself. But many believe the springs are becoming far too crowded and have lost the pristine appeal of yesteryear. Downstream on Barton Creek canoeing is a favorite sport, and many types of fish can be found.

As shown on the accompanying local area map, the four principal groups of springs, going downstream, are the **Upper (5a), Main or Parthenia (5b)**, which rise in the swimming pool, **Eliza (5c)**, and **Walsh or Old Mill Springs (5d)**. Another group of springs just below the swimming-pool dam probably represents leakage from the swimming pool. The average flow of the springs over an 87-year period has been 1,400 liters per second. The lowest recorded flow was 278 liters per second on March 29, 1956, toward the end of a seven-

year drought. The flow was also very low in 1877, when Paggi's mill had not run for three or four months, and the springs nearly went dry, being only a "hole of muddy water." The highest recorded flow was 4,700 liters per second on May 10, 1941. The available discharge records, in liters per second by water years, follow:

1895	480	1941	2,500
1896	710	1942	1,100
1897	1,400	1943	1,200
1898	710	1944	1,800
1899	540	1945	2,000
1900	2,000	1946	1,900
1901	940	1947	1,800
1902	650	1948	650
1903	2,000	1949	850
1904	1,200	1950	910
1905	1,800	1951	580
1906	680	1952	630
1910	540	1953	1,100
1916	850	1954	890
1917	480	1955	550
1918	510	1956	370
1919	1,500	1957	1,300
1920	2,700	1958	2,400
1921	2,300	1959	1,800
1922	1,600	1960	1,600
1923	1,000	1961	2,700
1924	1,800	1962	1,400
1925	1,000	1963	1,200
1926	1,800	1964	650
1927	1,000	1965	1,600
1928	940	1966	1,800
1929	1,400	1967	1,200
1930	820	1968	2,100
1931	1,800	1969	2,400
1932	1,000	1970	2,200
1933	770	1971	1,200
1934	1,200	1972	2,300
1935	1,700	1973	2,500
1936	1,200	1974	2,400
1937	1,400	1975	2,900
1938	1,500	1976	2,000
1939	570	1977	2,600
1940	850	1978	1,200



Location of the various Barton Springs.

On February 6, 1973, the flow of each of the four main groups of springs was estimated as follows in lps:

Upper	0	Eliza	140
Main	1,500	Walsh	250

The Upper Springs flow during higher total discharges. The water from Barton Springs is of very high quality, as may be seen in the table of Selected Chemical Analyses. It has also been tested for its content of some of the rarer chemical constituents. The analysis showed a content of less than 0.3 mg/l (milligram per liter) of strontium, less than 1.0 mg/l of lithium, less than 0.1 mg/l iodide, and 0.9 mg/l of bromide. These concentrations are not harmful for human consumption.

On Shoal Creek between 34th and 38th Streets in Austin are the two **Selders Springs (6)**. Gideon White

lived here from 1839 to 1842. The springs are sometimes mistakenly called **Cedars Springs**. They were described in 1839 as "a stream of limestone water which could be used as a water supply for the new capital." Between 1847 and 1865 Fort Austin and other Army camps used the spring waters. From 1871 to 1896 a popular resort and bathhouse was operated here by Ed Seiders. Bathtubs were cut out of the rock on the hillside and filled from the springs.

An attractive park with walks and benches has been developed around Seiders Springs in recent years. Ferns, yellow-flowered willow-worts, and poison ivy thrive around the water, as well as moss on the cliffs. Large pecan and live oaks, yellow-blossomed Jerusalem-thorn threes, and a cypress tree shade the site.

Seiders Springs are artesian, issuing under pressure from a fault in Edwards and associated limestones. Discharge records for the upstream (north) spring in lps follow:

Dec. 29, 1978	0.30	Dec. 18, 1979	0.85
Sep. 20, 1979	0.70	Dec. 29, 1979	0.71
Nov. 16, 1979	0.60		

The downstream Seiders Spring deserves special mention. It is the only ebbing-and-flowing spring in Texas. Within a certain range of discharges, the flow practically ceases for several minutes and then a large flow gushes forth for a brief interval before it subsides again. Discharge records in lps are shown in the following table:

Date	Constant Flow	High Flow	Low Flow	Period
Sep. 4, 1971	9.5			
Jun. 7, 1972		3.9	0.13	5 minutes
Jul. 18, 1976		3.2	0.44	5 minutes
Dec. 29, 1978	1.0			
Sep. 20, 1979	1.8			
Nov. 16, 1979	1.7			
Dec. 18, 1979	2.0			
Dec. 29, 1979	1.7			

The ebb-and-flow action is probably caused by siphoning of the water through the rock passageways from which the spring issues. Evidently a discharge of 2.0 lps is not enough to start the siphoning action, and 9.5 is too much. Further study of Seiders Springs will define more closely its behavior. Similar ebb-and-flow springs have been described in Missouri by Vineyard and Feder (1974).

Farther down Shoal Creek, at Sixth and Nueces Streets, **Durham Spring** was used as a camp for laborers in 1839.

**Cold and Deep Eddy Springs (10)** near Valley Springs Road on the south shore of Lake Austin in southwest Austin, include at least seven springs. They

issue under artesian pressure from a fault in the Edwards and associated limestones. Many Indian projectile points and tools have been found at the springs and in nearby caves along the Colorado River. The steamboat excursions to Bee Springs in the 1870s also stopped at these springs. Only two are above the normal level of Town Lake. In the words of Robert Hill (1892),

Almost due north of Barton Springs, along the same great fissure, and at the low-water level of the Colorado there is another outburst of artesian springs, but owing to the fact that they are at the base of a great bluff and accessible only by boat few people have seen them. This group of springs flows a great volume, but, inasmuch as they break out in the river's edge, it is impossible to gauge them.

Discharge records in liters per second are as follows:

1898	"large flow"	May, 1972	82-
Aug., 1917	120	Dec. 19, 1979	74
Feb. 8, 1941	85		

**Power House or Dam Spring (8)**, although man-made, should perhaps be mentioned. The spring appeared from terrace sand and gravel in the east abutment during construction of Lake Austin or Tom Miller Dam in 1893, producing about 120 lps. In 1895 the flow was 130 lps, in 1897, 280 lps, and in 1899, 230 lps. The dam failed in 1900 and was later rebuilt. The spring still drains through several pipes below the powerhouse, at 2 to 8 lps.

**Bee Springs (12)** are located close to Lake Austin, just upstream from the dam, on the west side where Bee Creek enters the lake. The group of five or more springs is located on or close to the Mount Bonnell fault, so that the water issues from both the Glen Rose and Edwards limestones. On September 3, 1972 they discharged at least 6.0 lps, some of the springs flowing beneath the surface of the lake. Near these springs are the summer nesting grounds of the rare golden-cheeked warbler, found in only a few localities in the Edwards Plateau.

**Mormon or Taylor Springs (4)** are a group of about 25 springs just beneath the surface of Lake Austin, on the east shore 2.4 kilometers from the dam. They flowed 42 lps in 1904 and 31 in 1973. They were used by a Mormon settlement in 1846 and 1847 to power a gristmill.

**Mount Bonnell Springs** are a similar group 200 meters farther north. This group of about 25 springs have nearly all been inundated by Lake Austin. They discharged 42 lps in 1904, 28 in 1918, and 31 in 1973.

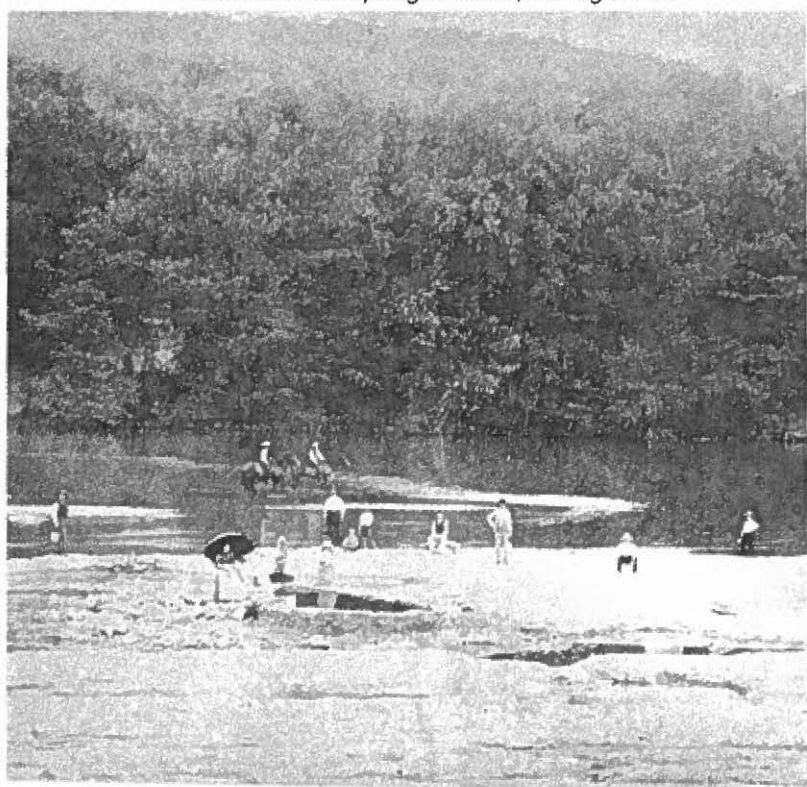
Both Mormon and Mount Bonnell Springs can be seen only when the surface of Lake Austin is drawn down for weed control, usually for about two weeks in the winter.

**Smith Springs (16)** may be found one kilometer southeast of the intersection of Loop 360 and Highway 2244 west of Austin. They are of interest because they were obviously much used by prehistoric men. Downstream along Smith Creek have been found numerous projectile points, stone axes, and a bedrock mortar, used for grinding corn, beans, or acorns into meal. They flowed 3.2 lps on March 18, 1975.

**Santa Monica or Sulphur Springs (19)** are 16 kilometers west-northwest of Austin, now beneath Lake Austin at the Panorama Ranch. In 1840 Bonnell called them **Agua Fria** (Cold Water). Here have been found numerous stone projectile points, scrapers, axes, knives, and manos or grinding stones, which indicate that the site was used intermittently over a period of several thousand years by prehistoric people. When settlers arrived the springs became a favorite resort. Their waters were bottled and highly valued for medicinal purposes. They issue from the Glen Rose limestone. Four kilometers southeast are the small **Brewton Springs**, near the old school of that name.

Several former springs are now beneath the waters of Lake Travis. These include **Salt Springs**, a few kilometers east of the Burnet County line, which were shown on several early maps. Another group now inundated was **Cedar Knob Springs**, eight kilometers downstream from the mouth of the Pedernales River, which were reported in 1925 to be discharging 2.8 lps.

*Santa Monica Springs in 1890, looking south.*



From the Austin-Travis County Collection, Austin Public Library

Five kilometers south-southwest of Cedar Park is a group of springs which include **Dipping Vat, Big House, Swimming Pool, and Kelly Hollow Springs (15)**, on the Dies and other ranches. Between 1863 to 1900 these springs provided the water which powered Anderson grist and powdermill three kilometers southwest. They have also been used for irrigation of crops. They flowed 14 lps in 1940 and 3.3 in 1972 from the Edwards and associated limestones.

**Spicewood Springs (26)** are near the writer's former home, at the intersection of Spicewood Springs Road and Ceberry Street in northwest Austin. They are said to have been a stop on an old Indian trail. Later they provided water for one of the first schools in Travis County, on a nearby hill. Discharge records in lps are:

Oct. 3, 1940	0.13	Sep. 15, 1979	0
Nov. 27, 1969	1.5	Nov. 8, 1979	0
Jul. 17, 1974	0.20	Dec. 18, 1979	0
Jul. 29, 1979	4.0	Dec. 29, 1979	0.67
Aug. 19, 1979	0	Jan. 8, 1980	0

The water pours from the cavernous Edwards limestone in the Balcones fault zone. Large fish and crawfish live in the pools, amid water cress, ferns, and elephant ears. Tony and Alice Ramirez, on whose property the springs flow, pump the water for lawn irrigation. Deer came here for water in dry periods until about 1975, when the surrounding area was covered with apartment and office buildings and superhighways. The spicewood shrubs are gone, replaced now by pecan, walnut, willow, chinaberry, and redbud trees. The similar small **Stillhouse Springs (25)**, three kilometers northwest, were depicted on some early Army maps.

**Pecan Springs (9)** pour into Tannehill Branch in east Austin, behind the Harvard Place apartments at 5020 Manor Road. Near here Josiah Wilbarger and his surveying party were attacked by Indians in 1833. Wilbarger received an arrow through the neck and was scalped and left for dead. He crawled to the springs where he was found, recovered, and lived many years afterward. Later the Pecan Springs school was located here. Historical markers commemorate these events. The original spring, which was walled in, usually no longer flows but contains a pool of duckweed-covered water. A short distance downstream there was still a flow of 2.5 lps from high gravel deposits on September 3, 1977, after several months of very dry weather.

**Park Springs (17)**, five kilometers southeast of Manor, trickle from high terrace gravel on top of Navarro shale. Discharging 0.31 lps on September 20, 1972, they gave their name to the community of Park



Springs just south, and were used as a water supply by the early settlers.

**Hornsby Springs (27)** are three kilometers south of Long Lake on E. W. Foster's ranch, operated by Don Dearing. They were the scene of an Indian campground in prehistoric times. In 1830 Reuben Hornsby built a cabin here, beginning what was later called the Hornsby's Bend settlement. The springs, which have never been known to fail, were used by many of the early residents. On September 17, 1978, 0.05 lps trickled from Quaternary gravel in a very dry period. An old log fence still surrounds the springs. Cattails and water cress grow in the stream, edged with purple ironweed. Large live oaks and pecan trees shade the site.

**Coleman Springs (28)** were in eastern Austin at Fort Colorado or Coleman's Fort. The site is now on Dr. and Mrs. Frank Blair's property at 5401 East Martin Luther King Drive. Soldiers at the fort used the water between 1836 and 1838. This was also a favorite Indian campground in earlier days. The strong springs issue from Quaternary gravel, feeding Fort Branch. They were used as a control point in early surveys. A deep hole which existed at the springs has been filled with sediment in recent years, according to Mrs. Blair. On September 17, 1978, after much dry weather, the springs were dry. A domestic well now pumps at the site. A dense wood of willows, post oaks, and elms surrounds the former springs. A granite monument nearby commemorates the fort.

In east Austin near the Brown Express Co. at 2,900 Oak Springs Drive were **Oak Springs (29)**. Here numerous springs formerly poured from river terrace gravel. According to M. C. Sandoval, a nearby resident, the springs essentially ceased flowing around 1960. Before that they were used to irrigate a garden, and also fed a stock-watering trough in a grove of live oaks west of the Oak Springs library. Some intermittent seeps still exist at the base of the bluff, and pools of water stand most of the year among willows in the Oak Springs playground to the south.

**Bluff Springs (18)**, fifteen kilometers south of Austin on Mrs. Barbara Holman's property, gave their name to the Bluff Springs community. In 1861 a company of Confederate soldiers camped here. The springs issue from the base of a high bluff of Austin chalk in a swampy area along Boggy Creek. The discharge has remained around 0.30 lps in 1937 and 1972. A group of small houses cluster around the springs.

**Manchaca Springs (10)** are located  $\frac{1}{2}$  kilometer west of Interstate Highway 35 just north of the Hays County line, on Mrs. Homer Heep's ranch, managed by Emory Puryear. They pour from Austin chalk. Many

projectile points have been found here. In 1709 the Spanish expedition under Espinosa, Olivares, and Aguirre is believed to have stopped here, as well as at McKinney Falls. The springs were named for Colonel Jose Menchaca of the Army of the Texas Republic. Since that time both the spelling and the pronunciation (Man-shack) have been changed. In 1845 two men were killed here by Indians. McClintock described the springs in 1846 as follows:

The spring is a very large one of limestone water, surrounded by a delightful grove of live, post oak, and cedar. High, rich, rolling prairie. Site for a tavern.

G. W. Colton called the springs **Onion Springs** (for the wild onions which grew here) on his 1872 *New map of the state of Texas*. They have also been called **Live Oak Springs**. They were a stage stop on the Austin-San Antonio Road and a stop on the Chisholm cattle trail. A mill was once powered by the spring waters. Hill and Vaughn (1898) described them as having a "large" flow, but less than that of Barton Springs. Discharge measurements in lps are:

Feb. 17, 1941	1.1	Apr. 27, 1973	13
1955	0.31	Apr. 2, 1978	4.2
Sep. 3, 1971	1.4	Nov. 16, 1979	3.7

The 1973 measurement followed a period of abundant rainfall. The water is no longer used, according to Puryear. It flows from a brick spring box through two pipes. One of these empties into a large circular steel tank covered with heavy incrustations of travertine. Maidenhair ferns, water pennywort, and water cress are abundant in the boggy area around the springs. Large water snakes live here.

**Thomas Springs (30)** are eight kilometers west-northwest of Oak Hill, and about 1.5 kilometers north-northwest of the Circleville store. The water trickles from Glen Rose limestone in a ravine, with many waterfalls and overhanging rock shelters. On April 29, 1979, there was an abundant flow, partly surface runoff, after heavy rains. The springs are reported never to fail. Water striders dart on the pools where water milfoil, buttercups, and sacaton grass grow. Large cedars and live oaks shade the springs.

In western Travis County is an area where geology has brought about a unique type of landform. Here the Cow Creek limestone is underlain by the easily eroded Hammett shale. When the shale is removed by stream waters, numerous overhanging cliffs or rock shelters result. Above the Cow Creek limestone lies the Hensel

sand, which usually contains water. (The Hensel, named for the Hensel ranch in northwest Travis County, is often misspelled *Hensell*.) This water flows out of the sand on top of the limestone, often forming delightful waterfalls. Two such springs are Hamilton and Westcave Springs.

**Hamilton Springs (2)** are about 16 kilometers west of Bee Cave, at Hamilton Pool on Eugene Reimers' property. The spring waters fall over the rim of a large rock shelter, which must have been used by early Americans for thousands of years, into a jade-green pool. Stalactites hang from the roof and mounds of travertine have been built up below, by the evaporation of the water. (See Plate 7, d). Many bats hide in the ceiling and maidenhair ferns grow on the seepy walls. Huge cypress trees and boulders fringe the creek downstream. The area has been developed for use by the public, with stairs down the cliff. The spring flow was 0.63 lps when observed in 1972 and 1978.

**Westcave Springs (3)** are 1.6 kilometers southwest of Hamilton Pool, across the Pedernales River. Westcave Preserve is owned by John Watson and tours are conducted by John Ahms. The springs and setting are quite similar to those at Hamilton Pool. Many stalactites and stalagmites have been formed by the falling water. Ferns, columbine, and wild orchids thrive in the mist of the waterfalls. A mineral curtain of orange travertine has formed a small cavern. Cypress and sycamore trees canopy the canyon, forming a sanctuary for the golden-cheeked warbler, cedar waxwing, nutria, ring-tailed cats, and other animals. One cannot but imagine how these picturesque springs looked when they were being used as a home by early Americans. The discharge was 0.19 lps in 1955 and 0.63 in 1972.

In the same general area, about 1.2 kilometers south of the Paleface store and the intersection of Highways 71 and 2322 is the nationally known Levi archeological site. Located on W. H. Fenoglio's property, the site is one of many rock shelters with associated springs along Lick Creek, formed in the same geologic strata as the shelters at Hamilton and Westcave Springs and containing many stalactites and stalagmites. A layer dated as 10,000 years old by radiocarbon techniques (11,000 years old when corrected for past climatic variations) contains Clovis and Plainview spear points and the bones of an extinct horse. Even older Paleo-Indian stone scrapers and choppers were found associated with the remains of an extinct tapir and dire wolf. About 100 meters upstream is **Levi Spring (20)**, which was undoubtedly used by these early American people. It flowed 0.63 lps from Hensel sand on July 12, 1975,

forming a waterfall over the Cow Creek limestone into a pool below.

## TYLER COUNTY

The springs of Tyler County are found mostly in the hillier north portion. They discharge chiefly from Tertiary sands (Oligocene Whitsett and Miocene Catahoula and Fleming) and Quaternary Willis sands. The Tertiary formations dip to the south-southeast at about 10 meters per kilometer. Bogs or baygalls are commonly associated with the springs.

For many thousands of years early Americans lived or camped at the springs. At the dawn of history in the areas the Caddoes occupied northern Tyler County and the Atakapans the southern portion.

The virgin forests were usually open beneath, because the dense canopy did not permit sufficient sunlight to penetrate to support any undergrowth. Bears, panthers, and other animals roamed the woods. With clearing and plowing of the land tremendous changes took place. Erosion produced sediment which choked channels and buried springs. Even so, some rare and endangered plants such as the Texas *Bartonia* survive around springs. European wild hogs and mixed-breed wolf-coyotes still roam the woods.

Although recharge is plentiful in most parts of the county, water levels have declined. In 1857 there were 27 water-powered mills using spring waters. Clearing and plowing of forest lands reduced recharge in some areas. Flowing wells wasted much water. In 1965 there were still 23 flowing wells, but few flow now. From 1955 to 1965 the water table declined as much as 2.2 meters in the Evangeline aquifer (Fleming sand). Naturally this has resulted in a decrease or cessation of some spring flows. Still, springs are numerous in the county, and only those of some importance are included here.

The spring waters are usually of a calcium or sodium bicarbonate type, fresh, soft, and very acid. The content of silica or iron may be moderately high. The fluoride content is usually less than desirable. Contamination of groundwater by oil-field wastes has occurred because of inadequate casing of wells and disposal of brine into surface pits. Most of the writer's field studies were made during the period March 12-17, 1978.

Adjacent to the amphitheater at the Woodville school are **Woodville Springs (5)**. The Spaniard Joaquin de Orobio y Bazterra may have stopped here in 1746 en route to Nacogdoches. According to J. B. Coffman, a local historian, the spring waters once powered a gristmill. In 1978 1.1 liters per second of iron-bearing water trickled from Willis sand.

Nine kilometers northwest of Woodville in a roadside park on Highway 287 are **Kirkland Springs (4)**. The park was given to the State Highway Department in 1934 by the Woodville Chamber of Commerce. Rock walls, a pool, stairways, picnic tables and a gazebo form an attractive setting. Many beech trees have been carved with initials, dates, and hearts. In 1978 springs discharged 0.35 lps from Fleming sand relatively high on a hillside.

**Cherokee Springs (12)** are nine kilometers southwest of Colmesneil on Myrtie Cruse's farm. They flow in a deep ravine 300 meters south of Cherokee church, near a former Cherokee village. Violets surround the springs in March, and magnolia, holly, and beech trees (with the usual carvings) shade the site. The discharge of 0.42 lps in 1978 from Fleming sand dropped over a series of steps at the downstream Highway 256.

Three kilometers northwest of Chester on Ray Barnes' lease were **Peach Tree Springs (10)**. They were called **Ta-Ku-La** (meaning Peach Tree) by the Alabamas who had a village and trading post here until forced out by the settlers. Now only seeps and pools of standing water from Fleming sand remain in a wood of large pine trees. They are at the base of the bluff 400 meters west of the Peach Tree Village hall, Kirby museum, and their historical marker. Springs also sparkle at Mt. Hope and Enon churches, four and six kilometers respectively east-northeast from Peach Tree Springs. They were formerly much used by the congregations.

Nine kilometers north-northeast of Chester were **Sulphur Springs (11)**, on Temple Eastex Lumber Company land. Loy Conner guided the writer to these springs, which were a health and recreational center in early days. People came great distances to drink and bathe in the clear and yellow waters. Bathhouses and boarding houses were built, and camp meetings were held here in summer. A few very small springs still flow from Catahoula sand amid dogwood and myrtle bushes. But the springs are now largely buried under sand. The 1836 Barnes water-powered gristmill was on Russell Creek to the northwest.

**Silver Springs (9)**, nine kilometers west-southwest of Colmesneil, give rise to Silver Run. According to Lou Ella Moseley, a noted Colmesneil historian, the name stems from rumors of an old silver mine which was never found. Nearby resident E. J. Bryant says that the Silver Run school used the spring water until about 1915. In 1978 a flow of 0.25 lps passed the road crossing, originating from Fleming sand.

Eight kilometers west of Colmesneil is Tanyard Branch, fed by **Tanyard Springs (8)**. A tannery once

used these waters. The flow from Fleming sand was 0.32 lps at the road crossing in March 1978.

Seven kilometers west of Colmesneil was the old sawmill and railroad town of Mobile. Near here Duesen in 1914 described a **Sulphur Spring (7)**. It was probably destroyed during logging operations. Nearby resident Garlin Davis has not heard of it. However, many very small freshwater springs occur in the vicinity.

Seven kilometers west-northwest of Colmesneil is the 1852 Enloe house with its historical marker, now owned by Betty Enloe. In a draw 150 meters north are **Enloe Springs (2)**, fringed with violets. Indians frequented the springs, and later a cane mill here was employed by everyone in the community, according to Moseley. The soils and vegetation indicate that the springs were once 100 meters closer to the house. They flowed about 0.07 lps of slightly milky water, containing a little clay, from Fleming sand in 1978. Some petrified wood occurs here. The 1840 Enloe grist, corn, and cotton mill two kilometers southeast was powered by spring-fed waters.

**Billiams Springs (3)** are five kilometers northwest of Colmesneil on Val Blanchette's ranch. Near here Alabama Chief Billiam's tribe lived. The many seeps flow into a small baygall containing cypress and bay trees. A huge cypress stump of the original forest still stands here. Beginning around 1880 many of the residents of Sunny Dell obtained water at this place. One of the springs was formerly curbed with wood. In 1978 0.55 lps issued from Fleming sand on top of a clay bed. The Wallace water-powered saw and gristmill was one kilometer northeast.

One kilometer north are **Sunny Dell Springs (6)**, 300 meters east of Sunny Dell church. The Sunny Dell log school was described by Moseley as being "near a large spring in a beautiful setting." Now there are only seeps and pools of milky water (containing some clay) from Catahoula sand. Yaupon shades the pools where marsh purslane thrives.

In a remote area eight kilometers west of Rockland, stands the historical monument for Fort Teran, on a bluff overlooking the Neches River. The fort was established by Mexico in 1831 in an effort to prevent further immigration from the United States. Mr. Coffman guided the writer to the site, owned by the county. Just to the west, at the base of the bluff, are **Teran Springs (1)**. They produce only about 0.07 lps in winter now, from Whitsett sand.

In the sandstone bluff below the fort site is a cave, and much digging has been done in the vicinity for a rumored Spanish gold cache. At various times the site has been known as Castillo's crossing, Boone's ferry,



Hawkins' ferry, and Belt's trading post. It also became a river boat port. The early travelers and settlers made good use of the springs. A few kilometers west are some saline springs which were an important source of salt to the Indians and early settlers. **Barrel Springs** with their school, store, and post office lay to the southwest.

Another **Sulphur Spring (13)** was located two kilometers south-southeast of Rockland on the railroad. It has been dry for a number of years. But on March 17, 1978, Sulphur Branch produced 2.5 lps of fresh water at the road crossing to the north, originating from Whitsett sand.

**Sugar Springs (14)** are four kilometers south-southeast of Rockland on H. G. Sutton's property on Sugar Creek. The name refers to James Sturrock's old sugar mill nearby. The springs once supplied water for the Southern Pacific railroad's locomotives. Later they provided a water supply for the town of Rockland. Now the town has a well, but a few houses still use the spring water. It flows from Catahoula sand at an elevation of 63 meters into a small reservoir. In 1965 and 1978 the discharge was 1.6 lps.

Lake Tejas is a CCC-built lake 1.6 kilometers east of Colmesneil, supervised by the Colmesneil Independent School District. Many springs (15) in the small drainage area of One Mile Branch feed the lake. Swimming and fishing are excellent in the sand-bottomed lake. On March 17, 1978, the lake was drawn down and numerous springs could be seen in the basin. In addition, 56 lps from Fleming sand was entering the basin from One Mile Creek. Spanish moss drapes the trees around the lake. Three kilometers downstream was the old Dave Tompkins water-powered mill.

**Snowden Springs (16)** are seven kilometers east-southeast of Colmesneil on Dee Fortenberry's land. Feeding Snowden Springs Branch, the water once powered a sawmill. The several small springs trickle from Fleming sand.

Seven kilometers northwest of Town Bluff are **Crumpler Springs (17)**, on Mrs. J. V. Ogden's farm. In 1914 Deussen described them as iron and sulfur springs flowing 1.6 lps. They still seep in the channel of Sulphur Branch by an old bridge, but their flow cannot be separated from that of the other springs along the branch. (See Plate 2, f). The total flow on March 17, 1978, was 3.3 lps. Many cypress trees shade the stream, where minnows dart. Deer and bobcat tracks may be seen in the sand. According to Mrs. Ogden, a fresh-water spring upstream was formerly much used for washing clothes by the area residents.

Northwest of Crumpler Springs on Tompkins Mill Creek there were once three water-powered mills: a

cotton gin, gristmill, and textile mill. According to Mrs. Moseley, this stream is now "greatly diminished in size from what it used to be."

Town Bluff and the adjacent Hanks ferry were settled in 1833. **Town Bluff Springs (18)**, flowing from the base of the bluff, were vital to the early settlers. Located on the Patty property across the road from a historical monument, they are in a deep ravine of caving Willis sand. According to Mrs. Joe Barlow, the former owner, many residents once did their washing here. Below the moss- and fern-covered banks are many bricks (probably the remains of a spring box) and old pots, pans, and kettles. Other smaller springs run nearby beneath the bluff. The discharge of 1.1 lps in 1978 emerged at an elevation of about 50 meters. The springs are not affected by Steinhagen Reservoir immediately north, whose normal level is only 25 meters above sea level.

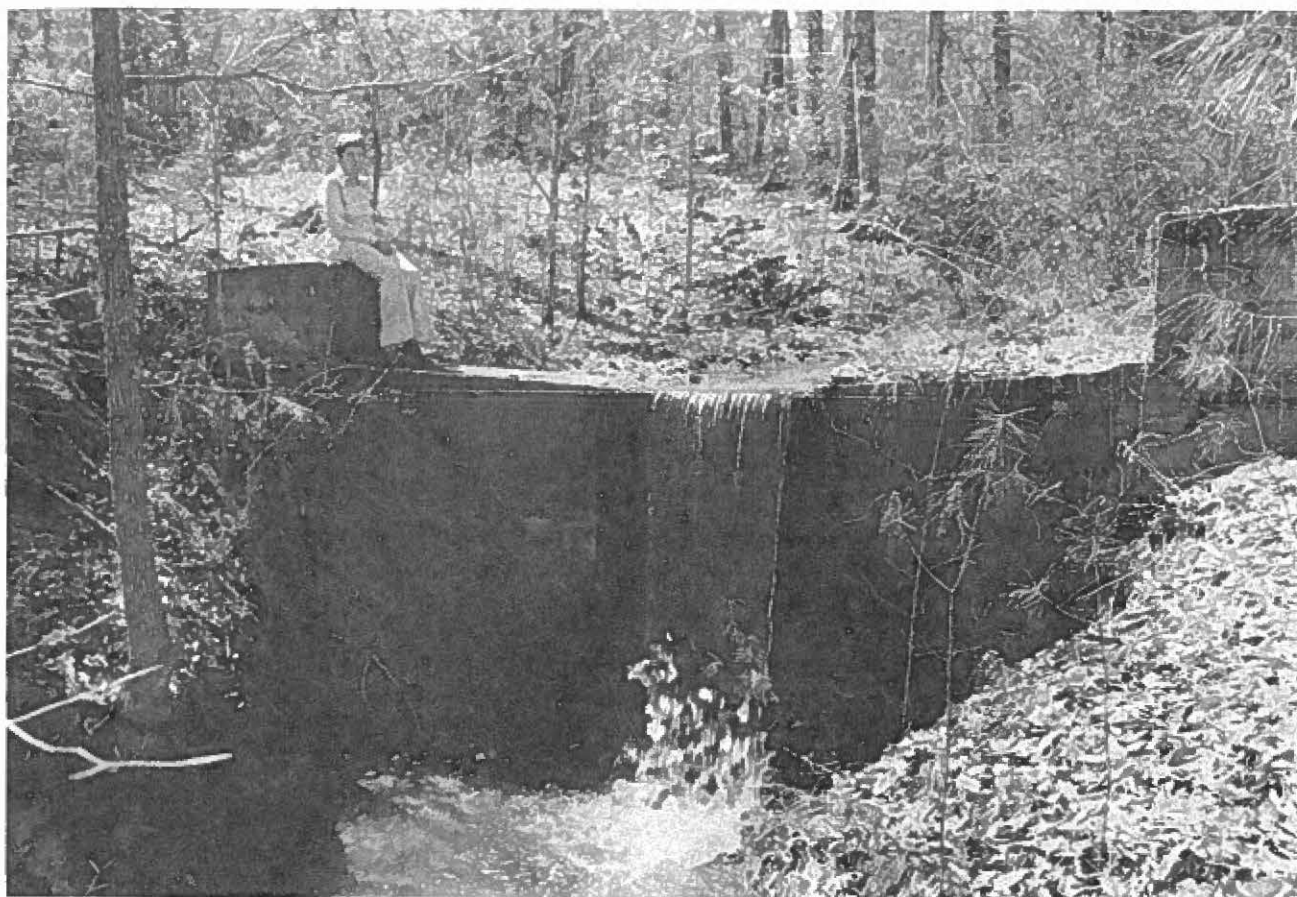
Around Spring Hill church, seven kilometers southeast of Woodville, several very small springs (19) trickle from Willis sand. About five kilometers east-southeast of here on Theuvenins Creek, Pope's water-powered cotton gin, gristmill, and sawmill once operated.

Four kilometers southwest of Woodville are **Urland Springs (20)** in Boy Scout Camp Urland. According to Camp Ranger Carl Rabickow, the iron-bearing water was formerly used by campers. Bay trees surround the springs, whose waters emerge at an elevation of 66 meters. The winter discharge is about 0.75 lps from Willis sand. Other springs supply Lake Urland, which is used for canoeing.

**Highway 190 Springs (21)** are five kilometers west of Woodville. Located in a roadside park, they have long been a popular spot for travelers. The springs discharge about 0.16 lps from Fleming sand through a pipe into a walled pool and then into a small lake. Barbecue grills and picnic tables are shaded by trees.

**Niwana Springs (22)** are at the Camp Fire Girls Camp Niwana eight kilometers west of Woodville. Several springs discharge from Fleming sand at an elevation of 87 meters. One group, called the **Chapel Tree Springs**, produced 1.1 lps on March 12, 1978, from the base of a large magnolia tree. According to Camp Ranger Wayne Attaway, outdoor services are held in an amphitheater here. Another group of about the same size includes one curbed spring formerly used by the camp. These and other springs supply several boating and canoeing lakes.

Just south of Camp Niwana are **Cedars Springs (23)** at the old Edgar Cedars homesite. They feed a small lake and form a beautiful waterfall over a concrete dam downstream. The winter flow is around 5.5 lps



*Cedars Springs.*

from Fleming sand. Redbuds, pink apple and peach blossoms, yellow forsythia, violets, and ferns adorn the site in spring.

**Hubert Springs (24)** are 17 kilometers west of Woodville, close to the Polk county line. The very small springs issue from white Willis sand in gullies just east of the old Hubert homestead and cemetery, feeding Hubert Springs Branch. According to Ray Hubert, a hunting camp used the water. Many yaupon, myrtle, and holly trees shade the springs. Champion International Corporation now owns the site.

## UPSHUR COUNTY

Evidence has been found that at least 9,000 years ago Paleo-Indians camped by Upshur County's springs while hunting and gathering fruits, nuts, and roots. This was long before the age of the bow and arrow. Later a mound-building agricultural people lived near the water. At the dawn of historic time the Caddoes lived in villages of thatched houses near the springs, cultivating crops and caring for domesticated animals. Around 1820 the Cherokees migrated to the area from their

homeland in the southeast, bringing with them roses and honeysuckle. Their stay was quite brief before they were killed or driven out by the settlers.

Most of the springs issue from Tertiary Eocene sands, primarily the Carrizo, Queen City, Weches, and Sparta. These sands dip chiefly toward the west into the East Texas embayment at about three meters per kilometer. Some flow from Quaternary terrace sands and gravels along the larger rivers.

Most streams are spring-fed and run the year around. In 1859 about 11 sawmills in the county used the water for power. In some areas there has been a serious decline in the water table, which of course has hurt the springs. For example, the water level in the Carrizo aquifer at Gilmer declined 0.9 meter per year from 1937 to 1966, and at Glenwood 3.4 meters per year from 1962 to 1967. There is evidence of much erosion in the past in the form of partially healed gullies. Although little land is cultivated now, many springs were buried beneath sediment originating from unwise clearing and plowing in the past. Numerous natural lakes formerly existed in the county. Now most have

Independence Springs, just east of Holly Springs church. A grove of holly trees, along with abundant ferns, shades the site. The Weches sand produced 0.20 lps in 1978. At Sand Hill, three kilometers south, and Camp Mountain, five kilometers east, other well-known springs flow. At Stamps, seven kilometers southeast of Holly Springs, pottery and other artifacts found near springs indicate long occupancy by early Americans.

Indian Rock park is nine kilometers east-southeast of Gilmer. Here a historical marker calls attention to numerous shallow mortar holes ground in an outcrop of Queen City sandstone by an ancient people. Springs (13) produced a flow of 4.7 lps on January 17, 1978, in the small creek 300 meters southeast, on Loyd O'Bryan's property. There is also a swampy area closer to the mortars, where springs probably issued in former times. Springs are also present at East Mountain, 12 kilometers south, and West Mountain, 11 kilometers south-southwest, both once favorite haunts of Indians.

**Phillips Springs (3)** are on the west shore of Lake Gladewater six kilometers north of Gladewater, on Jack Phillips' property. The mineral springs, valued for their supposed therapeutic effects, were developed in 1877. A constant stream of people came to drink the water, bathe in it, and spread the orange iron oxide on their sores. In 1895 a hotel was built here. In 1952 Lake Gladewater was built, with a spillway crest elevation of 93 meters, threatening to inundate the springs. Concrete walls were built around two of them, one mineral and one "freestone clear water." Within these walls the spring waters stand several meters above the lake level, inundating the gazebos over the springs. On January 18, 1978, 5.2 lps trickled from the many springs in Queen City sand in a pine woods park with numerous gazebos, tables, and benches.

**Hoover Springs (4)** are nine kilometers north-northwest of Gladewater on H. C. Mitchell's farm. In a formerly heavily wooded area, now in pasture, they form Hoover Springs "Glades" or swamps. According to Mitchell, a freighter camp was once located here. Many Indian artifacts have been found in the vicinity. On January 17, 1978, the springs proper yielded 0.55 lps, while the flow of Hoover Springs Branch at downstream Highway 1404 was 6.5 lps. The flow of similar **Sand Springs Branch** one kilometer south, at Highway 2685, was 1.8 lps. Killdeer are numerous around the springs.

**Dunaway Springs (1)** are at the Sabine River three kilometers west of Gladewater, on John Coby's property. According to Ed Wykoff, a nearby resident, Dunaway Camp was popular in the 1930s for swimming,

fishing, and outings. Now the camp has been closed, but on January 17, 1978, the springs still dripped 1.0 lps from the top of a Queen City sandstone bed about eight meters above the river channel. The rocks were covered with moss, roots, and icicles in a wooded area.

**Brown Springs (2)** are on the bank of the Sabine River seven kilometers west of Gladewater, on Alford Johnson's property. They were formerly much used by fishermen. On January 17, 1978, three groups of springs produced about 1.3 lps from terrace sand 10 meters above the river channel. The flow from one group disappears beneath sand and leaves, then reappears several meters farther down. The water contains pennywort, shaded by birch, ironwood, and ash trees. Coyotes and deer frequent the area. The similar **McGriff Springs** are one kilometer upstream. A nearby lake was scoured out and born during the 1913 flood, soon after the protective forest was removed.

Two kilometers east of Pritchett, on James Snow's farm, are **Snow Springs (12)**. The iron-bearing water discharged at 0.31 lps in 1961 and 1978, from Queen City sand at an elevation of 107 meters. The springs feed a series of ponds formerly used to raise minnows, now for livestock. On January 19, 1978, the springs kept part of the pond water from freezing over. (See Plate 5, b). Many other springs run nearby. Pond Creek, into which the springs discharge, was probably named for the numerous ponds, swamps, and glades once found here, now mostly drained.

**Elam or Lee Springs (7)** are seven kilometers north of Big Sandy and one south of Elam Springs cemetery on Robert Fience's property. They flowed from Weches gravel adjacent to a gravel pit at 0.75 lps in 1978, amid much marsh purslane. Many Indian artifacts have been found nearby. Similar but smaller springs trickle at the old settlement near the Hoover cemetery, four kilometers south.

**Maple Springs (8)** are ten kilometers north-northwest of Big Sandy on Steve Teague's property.

*Hoover Springs.*





Several springs produced 1.0 lps in 1978 from Sparta sand. The flow from one goes underground and reappears a few meters farther down beneath a pine tree. The springs probably originally extended upstream to near Maple Springs church, but the upper springs have now been buried under sand. Some maple trees still survive amid a predominantly birch wood.

Ten kilometers southwest of Enon, on Louis Carroll's farm, are **Barton Springs (9)**. On the old Barton place, they once furnished water for a sawmill and gin. Now the small springs trickle from Queen City sand in a pasture.

#### UPTON COUNTY

Most of Upton County's springs flow, or did flow, from vugular Edwards and associated limestones of the lower Cretaceous period, and a few from the underlying Antlers sandstone. These formations dip toward the southeast at about three meters per kilometer. Concho Bluff, trending northwest to southeast in the western part of the county, provided a favorable setting for several springs. The bluff runs into King Mountain, where several springs still trickle. At the southern end of the county is Southwest Mesa, also favorably situated for the formation of springs. The northeast part of the county is covered by Quaternary sand and caliche. Here, especially around the larger playa lakes, seeps once existed.

It is said that the Indians here, as in many other places in Texas, attempted to stop up the springs when they were forced to leave. However, this would be difficult to do as long as the water tables were high. The springs would merely find another place to break out. During the drought of 1903-1904, most of the springs dried up temporarily.

Water levels have declined considerably because of man's activities in recent years. Because groundwater is being withdrawn at a far greater rate than it can be replaced by recharge, it is essentially being mined, and eventually will be exhausted. Irrigation pumping of groundwater is the greatest offender. In the Midkiff area, the water table declined as much as 9.1 meters from 1937 to 1965. Of this, 7.0 meters of decline occurred between 1952, when large-scale irrigation began, and 1965. As a result, most of the springs have now failed.

The spring waters are chiefly of a calcium sulfate type, slightly saline, very hard, and alkaline. The fluoride content is usually high. The water was probably of a better quality in the past. Much was contaminated by leakage of oil-field brines from unlined disposal pits

and from inadequately cased oil wells. These practices are no longer permitted, but the damage has been done.

Most of the writer's field studies were made during the period April 11-16, 1979.

Ten kilometers east of Crane there were once very small springs (11) at the base of Concho Bluff. They were on Vannie Cook's ranch, managed by Bob Goekin. They issued from Quaternary caliche on Antlers sandstone near a caliche pit. Many Indian artifacts have been found here. The writer found a fragment of glass which an Indian in historic time had attempted to fashion into an arrow point. This was a well-known stock-watering place in early days. A grave is located nearby. According to Bob Boyd, who works on the ranch, the springs dried up around the 1920s. Now mesquite and other thorny brush cover the site.

**Flat Rock Springs (3)** were nine kilometers east of Rankin along the Santa Fe Railway, on Bud Poage's lease, on Rankin Draw. They were evidently a popular living area in ancient times. The outcrops of Edwards limestone from which the springs flowed are covered with mortar holes and pictographs of serpents, hands, and flowers. (See Plate 15, c). In 1684, the Spaniard Mendoza probably stopped here, describing the springs as an **ojo del agua delgado**, or "soft-water spring." In 1854, John Bartlett, exploring for the U. S. Army, wrote of these and other water holes:

On my return from California in 1852, I met several parties of emigrants from Arkansas and Eastern Texas, who had followed our trail from Fredericksburg to El Paso, and who were loud in their denunciations of those who had advised them to take this road, and more so of those who furnished them maps, which deceived them as to the watering-places. They expected to find water at the localities designated on the maps, and took no precautions in case of meeting with none. On reaching the so-called "Mustang Ponds," they did not recognize them and sought for them in vain for miles around. At the "Flat Rock" and "Wild China Ponds," they were equally disappointed. They looked about the desert without success. One party was seventy-two hours without tasting water, and came near perishing. Many of their mules and cattle died; and such as had strength remaining hastened on to the Pecos. There had been no water at either of the places designated during the spring or summer, nor was there any in October or November, when we crossed it.

In 1858-59, the Butterfield Stage stopped here. A U. S. Engineer Office *Map of Texas* in 1893, portrayed the **Flat Rock Water Holes**. Later the Flat Rock ranch, community, and dance hall grew up at the site. The springs have long been dry. Now yellow day primrose and purple milk vetch flowers adorn the spot in spring, along with cacti and yuccas.

**China Ponds or Wild China Water Holes (10)** were 17 kilometers northeast of McCamey on China Draw. They were on Bob and Laura Eaves' ranch. Folsom spear points were left here by ancient residents. In 1850 John Bartlett found the ponds to be dry, but judged from the "spongy appearance" of the soil that shallow wells would obtain water. In 1858, Oscar Call, a surveyor, noted that the ponds probably held water during most of the year. A stagecoach stand was located here then. In 1886, geologist C. G. Shumard described China Ponds as "a series of shallow basins in limestone." Later picnics were often held here on the 4th of July.

The water apparently seeped from Edwards limestone and Antlers sandstone. At one time a dam, long since broken, impounded the water. The water holes have long been dry and largely filled with silt. The chinaberry trees for which the ponds were named are gone. A few hackberry trees, cholla, mesquite, orange copper mallow and yellow day primrose flowers decorate the site. In 1966 (see table of Selected Chemical Analyses), water taken from a windmill well here with a water table 5.4 meters below the surface contained 1,660 milligrams of dissolved solids per liter. The seep water was probably fresher originally. Many oil wells pump to the northwest.

All of the following springs are around the base of King Mountain, issuing from Edwards and associated limestones. **Dead Man Springs (4)** are in Marlboro Canyon on the northeast side, on Charlie and Tinkie Speck's ranch. Several springs trickle here. Many rock shelters, burned-rock middens, and bedrock mortars are nearby. The springs received their name from a man who was chasing coyotes on horseback at night on the plateau above. He and the horse were killed when they plunged off the 35-meter cliff.

The main springs are walled up and used for stock water. On April 14, 1979, they were dry, but pools of live fresh water existed among the boulders about 30 meters lower. Here algae and milfoil grow, while flies, wasps, and butterflies frequent the edges. Purple milk vetch and phacelia flowers are numerous in spring. Persimmon, buckeye, willow, gray oak, and large cedar trees, as well as algerita shrubs, thrive in this lush canyon. Raccoons, ringtails, foxes, and bobcats frequent the vicinity.

**Barrel Springs (6)** were on the southeast side of King Mountain on Bob Ballinger's ranch, managed by Randy Herring. They were the source of Fivemile Creek. According to Mrs. Harry Howard, a neighboring rancher, the springs were formerly in a barrel, and a ladder provided access from the cliff above. They have

been dry for some years.

At the southeast point of King Mountain is a large white cross commemorating the service men who died in World War II. Here are seeps (7) which on April 15, 1979, ran 25 meters down the road ditch. Salt cedars grow in the wet soil.

On the south side of King Mountain, eight kilometers northeast of McCamey, were **Dripping Springs (8)**, on Frank Robbins' property. Now dry, they formerly flowed in a draw which is impassable in places because of the jumble of huge limestone boulders, cedar and salt cedar trees. Large pitahaya cacti grow on the adjacent slopes. Many oil wells pump above and below the former springs. Oil-field brine is dumped on a nearby hillside.

**Old Maid Springs (5)** are the most active of the county's remaining springs. They are on the south side of King Mountain, eight kilometers north-northwest of McCamey on Ed Hughes' ranch. This was a favorite haunt of ancient people, who left many burned-rock middens, bedrock mortars, and artifacts near the adjacent rock shelters. According to Cliff Newland of Crane, two old maids once lived here, giving the springs their name. Later a bootleg whiskey still was located at the springs.

The water has apparently been contaminated, containing 3,500 milligrams of chloride per liter. Many oil wells are located in the recharge area to the north on King Mountain. On April 15, 1979, the water trickled from seeps into pools among large limestone boulders at an elevation of 870 meters. Flies are numerous around the pools, which are shaded by salt cedars. On the adjacent slopes are large cedar trees and pitahaya cacti. Dark gray soils reveal that a swamp once existed below the springs. A few years ago a mountain lion was slain here after it killed many sheep.

**Cole Springs (2)** were on the west side of King



Old Maid springs.

Mountain on Bill Blackman's ranch, managed by B. J. Bowden. Here bedrock mortars, pictographs, metates, and projectile points have been found. According to Bowden, the water was formerly collected in a tank and pumped up onto King Mountain. A Cole ranch line shack was located here. The springs have been dry for many years. Creosote bush, yucca, and blackbrush now cover the area.

Between King Mountain and Castle Mountain, 12 kilometers southeast of Crane, is Castle Gap. Here, on C. C. Swift's ranch, were **Castle Gap Springs (1)**. The ancient Indians who lived here left mortar holes in the rock and several burials. In 1849, Lt. Francis Bryan stopped here, according to Haley (1952). He found a little water for his mules, but it was too muddy for the men to drink. In 1857, the Leach wagon train members described the water holes (Williams, 1953):

We then entered the Castle Mountain Pass or Canon, our road through it lying down an abrupt and in some places almost precipitous descent for some half a mile, near which portion of the canon are situated the pools of water which are the sole dependance of the traveller westward between Mustang Ponds and the Pecos River and this water is by no means permanent or reliable.

There is something of the romantic in the general appearance of this gap or chasm, as Castle Mountain Canon would be called by any one not versed in the nomenclature of those who were once the Spanish proprietors of the vast domain now known as the Lone Star State. Rocky walls some hundreds of feet in height, hem in and overhang the traveller, the shrill war whoop of the "Comanche" has so often echoed through the mazes of the Pass, that almost unconsciously the eye and ear are on the *qui vive* for some such manifestation of the ancient feud which these dusky devils bear to the white race. Nothing of the sort however happened to us. . . .

A halt was ordered in due time; the thirsty and tired animals slaked their desires in the muddy reservoir and left to themselves clambered up the rocky steeps which overhang the narrow road and cropped the scanty herbage the mountain sides afforded.

In 1858, Oscar Call found "good water and mesquite beans" for his horses at Castle Gap Springs. Legends of buried treasure at Castle Gap are rife. According to one, the Butterfield Stage was robbed by bandits around 1858. Seeing an army patrol coming, the outlaws hid the gold in a nearby cave and sealed it with rocks. Later all except a negro slave were killed.

Another story relates that in the 1860s a large shipment of gold and rifles was attacked by Comanches in Castle Gap. The wagon was pulled under a cliff and the cliff blasted off. One man escaped, but later when he returned could not find the treasure.

A third tale tells of a group of Maximilian's followers from Mexico arriving here in 1867 with a caravan of

wagons laden with gold coins and gold and silver vessels. The group was killed by six Missourians who buried the treasure. Five were later killed by Indians. The sixth man drew a map of the location of the buried treasure before he died, but nothing was ever found.

According to Cliff Newland of Crane, Castle Gap Springs were walled up before 1915. Until the 1930s the pools stayed full, but did not overflow. George McCorkle of Fort Stockton remembers a willow stump which stood here until about 1948. Some of the moss-covered rock walls can still be seen, but the springs have long been dry. Now cedars, mesquite, yucca, and creosote bush cover the site.

## UVALDE COUNTY

The Balcones fault zone passes through the center of Uvalde County from west-southwest to east-northeast. North of this zone many springs flow from the Edwards and associated limestones and some from the Glen Rose limestone. This water goes underground where the streams first cross faults in the rock, to form the Edwards underground reservoir. At other faults farther downstream the cavernous limestone is dammed by impervious formations such as the Eagle Ford shale. Here the water is forced to the surface through crevices as springs. These fault-zone springs include Cline, Soldiers Camp, Leona, and Sabinal Springs. Smaller springs formerly flowed in this zone also on Camp Lake Slough, Frio River, and Dinner, Blanco, and Nolton Creeks.

The formations dip to the south-southeast at about three meters per kilometer north of the fault zone, increasing to 20 meters per kilometer in the south. Some springs also originate in the Cretaceous Austin chalk, Eocene Wilcox sand, Pliocene Uvalde gravel, and Quaternary Leona sand and gravel. Many igneous basalt intrusions complicate the groundwater picture.

The annual discharge from wells in the county, chiefly for irrigation, in 1974 was 0.084 cubic kilometer, as compared with an estimated annual recharge of 0.24 cubic kilometer. Although the pumpage is considerably less than the recharge, it has nevertheless caused many springs to weaken or dry up.

Many of the larger streams disappear into alluvial cobbles and gravel and reappear at frequent intervals as springs. This phenomenon is known as stream or river "underflow."

The county contains many large caves in the Edwards and associated limestones. Cargile Cave on South High Street in Uvalde contained running water with eyeless fish. It has now been filled in. The 37-



kilometer-long Frio Bat Cave 10 kilometers southwest of Concan is noted for its bats, whose guano was once used in the manufacture of gunpowder and fertilizer. These and many other caves were formed by solution of the limestone by underground water, and were left dry when the underground channels moved to lower elevations.

Under the leadership of the late geologist F. M. Getzender, the county installed many injection wells, dams, and grates over natural openings in an attempt to increase the recharge to the Edwards underground reservoir. Whether these measures have had any significant effect is questionable.

For many thousands of years the Tonkawas and Lipans lived at the springs, leaving paintings in rock shelters and many artifacts. These people were loath to leave their beautiful homesites, and naturally fought the Spaniards, Mexicans, Texans, and U. S. troops furiously for the springs.

At the springs, water plants such as water cress, marsh purslane, water lilies, pennywort, and water milfoil thrive. In the immediate vicinity are usually found maidenhair ferns, cypress trees, large live oaks with much ball moss, cedars, and sycamores, and algerita, mountain laurel, and seep-willow shrubs. In the waters live crawfish, frogs, fish, snakes, mussels, snails, and various insects. Feeding upon these smaller animals are ducks, herons, killdeer, raccoons, armadillos, bobcats, and coyotes. Herbivorous animals which frequent the springs include several kinds of deer, turkeys, beavers, and nutrias.

The water is generally of a calcium bicarbonate type, fresh, very hard, and alkaline.

Most of the writer's field studies were made during the period January 5-10, 1979.

**Bird or Spring Branch Springs (9)** are 22 kilometers northwest of Uvalde near Chalk Bluff on Elmo Jones' ranch. They issue from a fault in Edwards limestones through terrace gravel. Elmo's daughter, Sky, has made an archeological study of 19 burned-rock middens here, finding them to range in age from Archaic to Late Prehistoric. Several bedrock mortar holes have also been found nearby. The name Bird Springs arose from the abundant granjeno shrubs whose fruit attracted many birds. In 1861, two men were killed by Indians here. The springs now supply the Jones ranch house. Discharge records in liters per second include:

May 2, 1940	110	Sep. 26, 1940	91
Jul. 9, 1940	88	Jan. 7, 1979	100
Aug. 28, 1940	100		

Three kilometers northwest of Bird Springs is Willard Wallace's Park Chalk Bluff. In the years 1929 through 1936, according to Wallace, there were many springs along the banks of the Nueces River here, some big. Now the springs come out only in the bottom of the channel. In the 1860s, Rangers and Confederate soldiers camped in the live oak grove.

**Candelaria Springs (2)** are 1.3 kilometers north-northeast of Montell on the Stockley ranch. They burst from alluvial gravel and are no doubt recharged by the Nueces River to the east. An ancient Indian village was located here. In 1762 the Spanish Mission Nuestra Senora de la Candelaria was established here. In 1766 the Marquis Cayetano Maria Rubi, on an inspection tour, described the mission as "on the banks of a little arroyo of very fresh and clear water." The water was used for irrigation of crops. Increasing raids by the Apaches and Comanches caused the mission to be abandoned in 1769. In 1858 a surveyor's camp was located here, and in 1870-81, Camp Montell occupied the site. Historical markers commemorate the mission.

On January 7, 1979, the discharge of Candelaria Springs was 87 lps. Other underflow springs appear along the Nueces River for several kilometers downstream.

Six kilometers northwest of Montell is **Norton Spring** on Oscar Hope's ranch. Here James and Allie Meriwether homesteaded in the 1890s. Norton Spring is only a seep now, but several other springs on Silver Creek (3) produced a flow of 3.5 lps at its mouth on January 7, 1979. The springs rise along igneous dikes in Edwards limestone. They feed several ponds in the Silver Creek ranch development. Old silver mines were once worked nearby.

In Machinery Hollow eight kilometers northwest of Montell, on John Rogers' ranch, are **Machinery Springs (4)**. Silver and gold mines once existed here. The water feeds an old concrete irrigation dam draped with ferns. On January 7, 1979, 2.5 lps poured out, depositing much travertine in the stream channel. Five kilometers southwest is the small **Boiling Spring**.

Two kilometers farther northwest on Montell Creek are **Wells Springs (5)**, also on the Rogers ranch. Here in 1870, Bill and Susana Wells settled. The old stone house still stands. They once chased a bear into nearby Palace Cave, where blind salamanders live. Burned-rock middens can be found near rock shelters here. The water has formed a series of spectacular travertine dams among the large boulders and cliffs. Maidenhair ferns, pennywort, and marsh purslane adorn the site. On May 3, 1956, the discharge was 0.19 lps, and on January 7, 1979—7.5. Travertine deposits five meters

higher than the present springs indicate that the springs once flowed at this higher elevation.

Several other small springs are located in the northwest corner of the county in the headwaters of Montell Creek. **Bobs Spring (6)** is five kilometers south-southeast of the corner. **Dripping Springs (7)** are three kilometers south-southeast of the corner on Judge Ross Doughty's ranch. Depicted on an 1892 U. S. Geological Survey topographic map, they produce about 0.20 lps. **Red Camp** and **Fat Hog Springs** are one and two kilometers respectively northeast of Dripping Springs on Robert McGowen's ranch. On January 7, 1979, the discharge of Montell Creek at the Rogers ranch house (including Machinery, Wells, Bobs, Dripping, Red Camp, Fat Hog, and other springs) was 58 lps.

**Walnut Springs (8)** are eight kilometers southeast of Montell on Archie Williams' ranch. Several large burned-rock middens are nearby. The springs issue from openings in massive Edwards limestone, forming the source of Sycamore Creek. They supply the ranch house and several ponds, flowing about 300 meters. Many large walnut and pecan trees tower above the springs. In 1956 the discharge was 1.9 lps, and on January 7, 1979—10. **Cave Spring** is two kilometers south-southeast of Walnut Springs.

**Newton Springs (20)** are five kilometers north-northeast of Reagan Wells on Albert King's ranch. They pour from a fault in Edwards limestone. Indian middens occur nearby. On October 11, 1956, the discharge was 1.9 lps, and on January 8, 1979—2.5. These and other springs make up the abundant flow of the Dry Frio River.

On the Dry Frio River two kilometers south-southeast of Reagan Wells are several springs. Their discharge was 9.9 lps on December 16, 1954, 5.1 lps on September 9, 1955, and 31 lps on January 16, 1958. They pour from Edwards limestone.

**Lightning Bug Springs (21)** are seven kilometers southeast of Reagan Wells on Dolph Briscoe's property. The water emerges from a fault in Edwards limestone, flowing into the Dry Frio River. It has formed numerous travertine dams among the water cress and pondweed. On January 8, 1979, the yield was 4.9 lps.

Eleven kilometers north of Uvalde on J. D. Willingham's ranch were **Worth Springs (28)**. Only a seep remains now of the springs which came out of a fault in Edwards limestone. Stone artifacts and burned-rock middens indicate that the site was occupied during late Archaic to late Prehistoric times (roughly 4,000 to 600 years ago). In 1854 Reading Black, founder of Uvalde, visited Worth Springs. In his diary of this trip he

wrote that he killed 10 ducks with one shot!

**Cold Springs (22)** are 13 kilometers north of Concan at Andy Novak's Cold Springs resort. They gush from massive, cherty Glen Rose limestone among odd-shaped rock formations on the east side of the Frio River. An Indian village once was located here, as evidenced by middens, projectile points, and metates. Enormous cypress trees shade the very clear pool fed by the springs, where bass and perch thrive. (See Plates 7, a and 12, c). Discharge records in lps are:

Jan. 6, 1955	14	Jan. 8, 1979	14
Sep. 9, 1955	17		

Three kilometers northwest of Concan on Jerry Jones' property are **Doughty Springs (24)**. These small springs are reported still to flow from Edwards limestone.

**Concan Springs (23)** are in John Buchanan's campground just north of the Concan store. Rock shelters here were probably used as homes by prehistoric people. Huge cypresses shade the park with its picnic tables and barbecue pits. The red leaves of marsh purslane color the spring waters. On January 8, 1979, 12 lps surged out, flowing to the Frio River. (See Plate 10, c).

Two kilometers north of Concan on Kenny Arthur's property were **Cowan Springs (26)**. They flowed from a very vugular Edwards limestone, but on January 8, 1979, were dry.

On Bear or Blanket Creek about 10 kilometers north-northeast of Concan are **Bear Springs (25)** on Archie Kelly's property. Here A. B. and Sue Kelly settled in early days amid much wild game. Indians often came to the springs while the Kellys lived there. These and other springs produced a flow at the mouth of Bear Creek of 48 lps on January 8, 1979.

Five kilometers east-northeast of Concan are a second **Dripping Springs (27)** on Jim Collins' ranch.

**Peters Springs (31)** are nine kilometers east of Concan on the K. D. Storey ranch. They flow from a fault in Edwards limestone on the east side of Blanco Creek 15 meters above the creek bed. A large burned-rock midden is at the springs. Here the Peters family settled in 1874, walled up the spring, and piped the water to their cabin. The water still supplies the Storey ranch headquarters and corral. Maidenhair ferns drape the rock walls. On November 26, 1956, the discharge was 0.95 lps, and on January 9, 1979—1.0. In Blanco Creek above this point an additional 11 lps originated from other springs. This flow disappears into faults which cross the creek about three kilometers down-

stream, called the "sinks of the Blanco." The small **Reiner Springs** are three kilometers southeast of Peters Springs.

**Ware Springs (29)** are two kilometers south of Utopia on Harold Donoho's ranch. Here Capt. William Ware built a cabin in a pecan grove in 1852. The cabin still stands, protected by a steel shed. The springs pour from Leona gravel in a small draw bordered by large cypress trees. On January 9, 1979, 2.6 lps flowed through the remains of an old stone dam where water striders dart, and into the Sabinal River.

**La Jita Springs (30)** were five kilometers south of Utopia at a Girl Scout camp managed by Allen Phillips. *La Jita* in the Indian language means *precious possession*. Burned-rock middens and stone projectile points, knives, axes, and metates bear witness to the love of the Indians for this area. In 1790 Col. Juan de Ugalde burned the Apache villages here and defeated the Indians. In the 1860s the private Fort Anglin was nearby. In 1866, an irrigation ditch carried the spring waters to crops, according to Phillips. A gristmill and cane press used the water for power. The springs are little more than seeps now. They have probably been affected by floods and changes in the course of the Sabinal River.

**Sabinal Springs (32)** give rise to the Sabinal River just upstream from the Southern Pacific Railroad bridge at Sabinal. Water which sinks into faults in the Balcones fault zone on the Sabinal and other streams to the northwest reappears here, probably through faults beneath the alluvial gravel. In 1854 George Hammer built his stage stand at the springs. In 1856 Camp Sabinal was located here, and later a Ranger camp occupied the site. Albert Myer described the Texas Rangers very succinctly in letters from Texas in 1854-56 (Clary, 1978):

Take one of the lowest Canal drivers, dress him in ragged clothes—those he ordinarily wears, as you see him, are altogether too clean—put a rifle in his hand, a revolver & big bowie knife at his belt—utterly eradicate any little traces of civilization or refinement that may have by chance been acquired, then turn him loose, a lazy ruffianly scoundrel in a country where little is known of, less cared for, the laws of God or man and you have the material for a Texan Mounted Ranger, an animal—perhaps I should say a brute—of whose class some hundreds are at present mustered into the service to fight Indians. There are exceptions.

But, to return to the subject at hand, on January 10, 1979, 10 lps broke forth from Sabinal Springs amid a grove of large cypress trees. A historical marker is located on Highway 90.

**Leona (Mountain Lioness) Springs** are on the

Leona River south of Uvalde. The Edwards aquifer from which their water gushes is recharged by water from the Nueces River and other streams to the northwest, which enters the aquifer through faults. Along the Leona River this water rises under artesian pressure through other faults into alluvial gravels and thence to the surface. Spring flow generally lags behind rainfall by several months. There are four main groups of springs. In the past, when they poured from higher elevations; they could readily be identified and their discharges measured. Now, however, nearly all are beneath the surface of the river.

The first group of Leona Springs (11) emerged between the Southern Pacific Railroad and the Highway 140 bridge. Here W. W. Amett built his cabin in 1852. In 1857 Frederick Olmsted wrote:

We accompanied, on the following day, an ambulance excursion to visit an Indian camp at the head of the Leona, three miles north of the fort. It was the first time I had had the opportunity of coming in contact with the native savage unalloyed, and my curiosity was on the alert. The camp was of a portion of the tribe of Lipans, with a few Tonkaways, and Mescaleros—numbering, perhaps, in all, one hundred. They had been recently brought in from the plains by the Indian agent, according to a treaty by which they were to receive a certain pension in clothing and food, for keeping quiet, and for substituting the use of the plow for that of the scalping knife.

The approach to the camp was at least satisfactorily picturesque; a group of wigwams, bright blankets, and camp-fires were scattered through the shady grove round the spring, suggesting a pleasant sketch of the natural socialism of the uncontaminated man.

In 1858 Reading Black and James Taylor used the water of Leona Springs to operate a gristmill. In 1868 the springs were described as "abundant springs, 15 feet wide and six inches deep, running rapidly." Until 1893, when a well was drilled, the city pumped water from these springs. The largest in this group were Mulberry Springs, 2.5 kilometers southeast of Uvalde on Sue Johnson's ranch. In early 1900 they were flowing; in September, 1900, they were dry, and on December 1, 1900, they produced 28 lps. Here, was a 6-meter-deep hole called the "Big Boys' swimming hole," according to Mrs. Johnson. It contained many large fish. It is now filled with sediment, and cows sometimes get bogged down in it. The mulberry trees are gone.

Another large spring of the first group of Leona Springs formerly existed at the Highway 140 bridge. It was shaded by a huge oak tree, which blew down in 1977. This spring was a very popular stop for travelers, according to W. A. Kincaid, Uvalde historian. It was



partially covered up when the new bridge was built, but still flows.

Now the farthest upstream springs are at the No. 2 green on the municipal golf course, or two kilometers downstream from their original location. On January 10, 1979, with an air temperature of 5°C, much steam was rising from the first group of Leona Springs amid cattails and water cress. Discharge records in lps by water years follow:

1859 (part)	0	1930	0
1870-1884	Flowed	1931	88
1885	0	1933	540
1886-1892	Flowed	1934	190
1893	0	1935	40
1896	310	1939	200
1898	0	1940	200
1899	0	1941	170
1900	140	1942	200
1904	620	1943	230
1906	370	1944	110
1910	240	1945	28
1912	0	1946	0
1925	110	1947	99
1928	25		

The second group of Leona Springs (12) is located four kilometers southeast of Uvalde in a county park. Here Fort Inge was located from 1849 to 1861 and from 1866 to 1869. A Ranger camp also used the site later. The springs are beneath the waters of an old irrigation reservoir on the Leona River, now used for recreation. Adjacent to them is Mount Inge or Pilot's Knob, formed by an intrusion of basalt. In 1853 the river at Ft. Inge was described as "swift and clear, some 30 feet wide and two feet deep." Discharge records for the second group, in lps by water years, follow:

1925	150	1942	400
1931	140	1943	400
1934	220	1944	230
1935	150	1945	230
1939	200	1946	74
1940	370	1947	180
1941	340		

*Travertine dams and waterfall at Leona Springs (13)*



The third group of Leona springs (13) is eight kilometers southeast of Uvalde on Mrs. John King's ranch. The writer was kindly guided to them by Al Wilkerson, who lives nearby. The springs emerge beneath the Leona River waters forming travertine dams. These dams form two beautiful waterfalls, between which is a Geological Survey stream gauging station. Some of the flow disappears into a travertine formation in the left bank and reappears a short distance downstream. Water cress, water pennywort, cannas, and elephant ears are abundant. Discharge records for the third group, in lps by water years, follow:

1925	45	1939	180
1931	240	1946	130
1934	120	1947	200
1935	140		

In recent years the combined flow of the first through third groups of Leona Springs has been measured. These measurements, in lps by water years, follow:

1934	400	1960	880
1935	400	1961	880
1936	930	1962	790
1937	960	1963	200
1938	820	1964	3.1
1939	570	1965	2.0
1940	570	1966	8.5
1941	480	1967	14
1942	760	1968	140
1943	680	1969	250
1944	310	1970	590
1945	370	1971	340
1946	170	1972	710
1947	280	1973	850
1948	200	1974	850
1949	85	1975	1,500
1950	400	1976	1,200
1951	18	1977	2,000
1952-58	0	1978	1,200
1959	180		

The maximum recorded instantaneous flow was 2,410 lps on January 31 and May 25, 1977. It should be noted that in years in which both separate and combined discharge measurements were made, the separate measurements generally total a greater amount than the combined flow. This is because some of the flow of the upper springs (first and second groups) was lost to the alluvial gravels before reaching the third group of springs where the combined flow was measured.

The fourth group of Leona Springs (14) is 15 kilometers southeast of Uvalde in Leona Estates. They emerge under water just upstream from an old washed-out irrigation dam on the Leona River. Discharge

records in lps by water years follow:

1917-19	0	1935	160
1925	340	1939	190
1931	340	1946	85
1934	150	1947	160

On the Nueces River two kilometers south of Highway 90 and upstream from the Tom Nunn crossing are **Soldiers Camp** or **Rose Springs (33)**. They are on Bill Allen's and Robert Coleman's property. They were portrayed on Lt. G. W. Martin's 1894 map, *Reconnaissance of the road between Ft. Clark and Uvalde, Texas*. In 1898 Hill and Vaughn wrote:

Water rushes out in a stream of considerable size, and is cool, clear, and pure, and surrounded by splendid growths of pecan trees.

The fresh water issues from river gravel and cobbles, but probably rises through faults from the Edwards limestones as at Leona Springs. Discharge measurements in lps follow:

Mar. 25, 1924	610	Jan. 24, 1932	230
Apr. 30, 1925	120	Nov. 2, 1932	930
May 16, 1931	570	Jul. 24, 1933	460
Jun. 5, 1931	830	Jun. 17, 1939	250
Jun. 16, 1931	480	May 2, 1940	240
Jun. 23, 1931	530	Jul. 9, 1940	310
Jul. 3, 1931	580	Aug. 28, 1940	230
Jul. 9, 1931	570	Sep. 26, 1940	200
Jul. 17, 1931	530	Nov. 23, 1964	470
Aug. 30, 1931	540	Jan. 10, 1979	240
Nov. 15, 1931	250		

**Cline** or **Turkey Springs (1)** were originally two kilometers southwest of Cline on Turkey Creek on Lloyd Kirkpatrick's ranch. They were described by Lt. S. G. French (U. S. Senate, 1850) as follows:

The banks of the creek are bordered with post and live oak. The grazing is fine and abundant. At this place, owing to heavy rains, the command was stopped nine days. The road heads the main spring from which the creek rises, though, on our return, water flowed from a small lake a little higher up.

The lake which he mentions was probably the Government Water Hole in Kinney County. In 1857 J. C. Reid camped at Cline Springs, finding enormous flocks of turkeys roosting in the trees. He wrote:

Turkey Springs; excepting San Pedro, is by odds the best spring we saw.

He found a man and his wife living here. In 1870 Celeste Pingnot operated a stage stand and store a short distance below Cline Springs. A small detachment of soldiers was billeted nearby. Pingnot told his son Ed, of Uvalde, that water usually flowed "belly deep to a horse" at the stage stand. This land is now leased by D. P. Gallman. According to Pingnot, the springs near the stage stand became intermittent around 1900, and ran well for the last time in 1946.

Now the highest springs are five kilometers downstream on Turkey Creek, on J. H. White's ranch. They apparently rise through faults from Edwards limestone, issuing from Anacacho limestone at the surface. At the ghost mining town of Blewett the discharge was 23 lps on January 15, 1979. At the Zavala County line it reached 29 lps, and about seven kilometers south of the county line Turkey Creek was dry. Near Blewett the waters feed a lake, whose concrete dam is festooned with maidenhair ferns. Willows, chinaberries, cane, cat-tails, water plantains, and pondweeds thrive here.

## VAL VERDE COUNTY

Val Verde County is one of the richest archeological areas in Texas. It was natural that men and women should be living here more than 10,000 years ago, as radiocarbon dating shows. The many rock shelters and caves in the canyons afforded protection from inclement weather. Springs and spring-fed streams provided convenient sources of pure water. And where there was water there was also abundant game, fruit, and nuts. Because the interiors of the rock shelters have remained dry for thousands of years, very old rock paintings and priceless artifacts of wood, fiber, and skin, which would otherwise have long since rotted, have been preserved.

When De Sosa trekked through the county with his ox-cart caravan in 1590, he saw "large seas of waving grass." Heavy grazing by cattle caused the grasses to die out and be replaced largely by mesquite, sagebrush, and blackbrush. When there was no longer sufficient grass for cattle, sheep were turned onto the land, and in many cases the sheep have been replaced by goats.

This overgrazing has destroyed the natural layer of organic mulch which formerly overlaid the soils in the recharge areas. The bare soils are no longer capable of absorbing rainfall, and much of it runs off. As a consequence spring flows are declining in many cases. The primary aquifer in the county is the Georgetown limestone, of the Edwards and associated limestones. These limestones receive their recharge in an area as far north as Sheffield in Pecos County and Eldorado in

Schleicher County. Heavy well pumping in this area, especially for irrigation, of course affects the springs in Val Verde County. Amistad International Reservoir, completed in 1968, has covered some large springs, but at the same time has increased the flow of others downstream.

Many rare animals make their home in the springs environment. These include the gray-banded king-snake, Baird's rat snake, Devil's River black snake, the barking frog, which sounds like a dog, the bald eagle and black hawk, and fishes such as certain Gambusia, the Rio Grande darter, and stoneroller. In the many caves associated with the springs may be found eyeless and unpigmented isopods and tailless whip scorpions. Common plants in the springs include southern maidenhair and shield ferns, moss, water cress, water pennywort, spikesedge, and marsh seedbox.

As shown in the table of Selected Chemical Analyses, the spring waters are of a calcium bicarbonate type, fresh, very hard, and of neutral to alkaline pH. The water of San Felipe springs was analyzed in 1972 for contamination by pesticides and herbicides. No significant amounts of these compounds were found, but the danger of pollution of the cavernous limestone aquifer remains.

Most of the writer's field studies were conducted during the period September 24-October 2, 1976.

At the mouth of Everett, or Evert, Canyon on the Pecos River at latitude 30°00' and longitude 101°30', and extending about 500 meters up the canyon, are **Everett Springs (13)**, on Gilbert Marshall's ranch. The water flows from a cavernous layer in the Georgetown limestone, which is at the stream bed in the upstream springs but about seven meters above it at the canyon mouth, producing a beautiful waterfall. There is a high bluff above the springs with a shallow rock shelter, probably occupied at one time by Paleo-Americans. Cardinal-flowers and buttercups decorate the scene, shaded by live oaks. This is a hunting and fishing area, with numerous deer and javelina. The springs were formerly used for irrigation. Discharge records in lps include:

May 15, 1939	38	Feb. 7, 1968	25
Jul. 21, 1943	480	Oct. 1, 1976	210
May 2, 1962	31		

Many other springs, some large, occur in this vicinity. Across the Pecos River are **Cox Springs (36)**, which flowed 52 lps in 1939, but which since the 1954 flood have been covered with sand and cane, and no longer flow as copiously. Eight kilometers southeast on the Pecos River are **Wildcat Springs (37)**, also called

**Martin Springs** on the Rand McNally 1883 Map of Texas and Indian Territory.

Fourteen kilometers up the Pecos River on Tom Everett's ranch, are **Tardy Springs (11)**. Flowing from vugular limestone, they poured out 75 lps in 1939, 31 in 1962, 54 in 1969, and 12 in 1976.

**Babb Springs (42)** were four kilometers west of Tardy Springs, on the opposite (west) side of the Pecos River at the base of a limestone bluff. In 1939 they produced 30 lps of water. Since the great flood of 1954 on the Pecos, they have been in the river channel, like many other springs in this vicinity, and can no longer be seen.

Three kilometers south of the Pandale community in northwestern Val Verde County, at the base of a bluff on the south side of Howards Creek, are **Howard Springs (12)**. Flowing from a very cavernous layer in the Georgetown limestone, they are surrounded by live oak trees. Much used as a stage station by early travelers, Howard Springs should not be confused with another Howard Springs, also an important stop in early days, upstream in Crockett County. The springs' discharge was 74 lps in 1939, 96 in 1943, 110 in 1969, and 14 in 1976.

The Devil's River has one of the largest base flows of Texas' rivers. The reason, of course, is the many large or moderately large springs which supply it. Many of these discharge beneath the river's surface, and cannot easily be seen until the river changes its course. They were very important to early travelers, as well as to Paleo-Indians. **Beaver Springs (38)**, on the W. T. Mayfield ranch six kilometers upstream from Juno, were described in 1916 as a beautiful stream with large live oaks. In 1925 they flowed 45 lps. In 1939 they were reduced to 0.38 lps. In 1971 and 1976 there was no surface flow. In 1976 there was a *charco* or river channel pool 500 meters long here, and probably there was some flow through the underlying gravel. The beavers of course have been exterminated.

At and just above Juno is another group of springs variously called **Juno, Headwater, Stein, and San Pedro Springs (14)**. In 1849 Robert Eccleston caught several 20-pound (9-kilogram) catfish and large buffalo fish in these "small springs." The historic Juno store here, which opened in 1880, closed in 1975. In 1925 these springs discharged 115 lps. The discharge dropped to 0.85 lps in 1939 and 0 in 1971. On October 1, 1976 the springs were again flowing at 28 lps. From there downstream many other springs enter the river. Three kilometers south at its junction with Johnsons Draw, which was dry, the Devil's River flow had in-



creased to 280 lps on the above date.

There appears to have been some decline in spring flow along the Devil's River. This is probably due in part to irrigation pumping in the recharge area to the north. Overgrazing has also been a major factor, through compaction of the surface soils and reduction of recharge to the aquifer.

About 12 kilometers down the Devil's River from Juno on the right bank, on the Hudspeth River ranch, are the large **Pecan Springs (15)**. They are the main source of the Devil's River, rising at an elevation of 490 meters. In 1849 Lt. W. H. C. Whiting (Whiting and others, 1938) wrote:

... a still and beautiful lagoon of clear blue water, half hidden by a dense grove of lofty pecans. The picture was enchanting. ... this spring which the Indian alone knew — the water so still and silent in its soft light — around it the somber green of the superb pecan, and above all a frowning background formed by the huge, dark gray cliffs of limestone. Hard by were the frames of the Comanche lodges, and many a deep-worn trail we now discovered.

Hill and Vaughn (1898) described them as "a sparkling spring of pure limpid water, and its taste is delicious." In 1892 the yield was 23 lps, in 1925 it was 1,200, in 1939 it was 190, and in 1976, 390 lps. Many deer make their home here.

Five kilometers farther south, at the mouth of Brush Canyon, are **Hudspeth Springs (16)**. They issue through gravel on the right (west) bank of the Devil's River. They have been used for irrigation in the past. Beavers still struggle to exist here, but are fighting a losing battle. A grove of pecan, sycamore, and walnut trees encloses the springs. The flow was 65 lps in 1939, 100 in 1969, and 160 in 1971. In 1976 a flow of only 3 lps was visible, a much larger volume probably entering the river through gravel and cobble deposits.

Two to three kilometers downstream from the Highway 163 crossing of the Devil's River, on the W. C. Thompson ranch, are **Huffstutler Springs (17)**. Plainview projectile points and radiocarbon-dated charcoal, along with many more recent artifacts, indicate that this site has been occupied off and on for over 9,000 years by early Americans. From 1857 to 1868 Camp Hudson, from which the Army's camel experiments were carried out, was situated nearby, as was Baker's Crossing of the river in 1883. As the Devil's River is a navigable stream here, many canoists float down it to Amistad Reservoir. The springs, mostly covered with tall grass and cane, may be seen from the river. The owners are trying to preserve the area's natural beauty and do not encourage visitors.

Farther downstream, on the east bank of the Devil's River, are **Finegan Springs (33)**, on the ranch of that name, at latitude 29°54' and longitude 101°00'. This large group of springs issues from the base of a limestone bluff about five meters above the river, 1.6 kilometers north of the juncture with Dolan Creek. Many artifacts have been found here. During strong spring flows there has been a waterfall at a higher elevation. The discharge was 99 lps in 1928, 760 in 1939, 110 in 1966, 110 in 1969, and 570 in 1971.

Three kilometers east-southeast of Finegan Springs, on Dolan Creek, are **Dolan Springs (21)**. Also called **Snake Springs**, Dolan Springs were much used in ancient times, as evidenced by many nearby rock shelters with pictographs and bedrock mortar holes, burned-rock middens, and stone projectile points and tools. In 1873 there was a fight with Indians here. In 1883 settler H. K. Faucett carved his name in a rock shelter. Spice (1954) described Dolan Springs well:

The main aquifer is a rotten, oxidized limestone bed that crops out only a few feet above the bed of the river in this area. Dolan Springs, issuing from beneath a 200-foot bluff, forms a clear blue-green pool of water, whence it flows for a mile over a bed of pure limestone scoured into channels and pools until it enters Devils River at the southwest extremity of the map. There is not just one spring but a series of springs that gush from the porous rock. ...

During the severe drought which started in 1949 and has yet to end in 1954, these two series of springs [Dolan and Finegan Springs] have kept Devils River flowing. Above the Devils River springs, water ceased to flow for the first time in recorded history in July 1953, but these springs, though diminished, continued to produce enormous quantities of water.

Water lilies and trees are numerous. Discharge records for Dolan Springs in lps by water years follow:

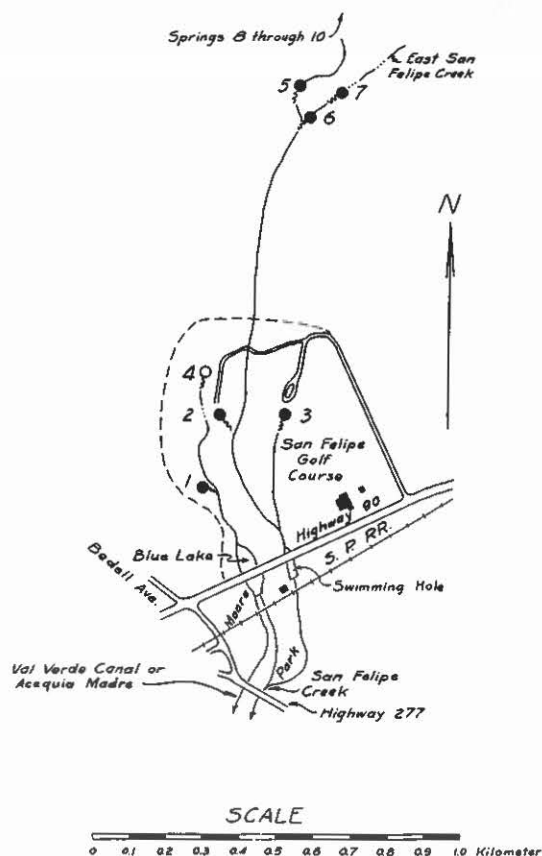
1928	57	1971	34
1939	195	1972	220
1966	160	1973	210
1967	68	1974	120
1968	48	1975	480
1969	31	1976	400
1970	85	1977	510

The maximum recorded flow was 710 lps on July 18, 1976. The minimum was 28 lps on several days in May, 1971. The average discharge has been 190 lps. Thirteen kilometers north of Dolan Springs are the smaller **Norris Springs (31)**.

Thirteen kilometers southwest of Finegan Springs on Dead Man's Creek is a spring called **Dead Man's Hole (39)**. W. R. Shafter depicted it on his 1877 *Map of parts of Texas, Mexico, and New Mexico*. It is now dry.

**Gillis Springs (22)** are on the Walter Gillis ranch at latitude  $29^{\circ}43'$  and longitude  $101^{\circ}02'$ . They issue from Georgetown limestone on the right bank of the Devil's River. They were called **Willow Springs** on some old Army maps. The flow was 180 lps in 1928, 5.1 in 1939, 6.2 in 1967, and 260 in 1971. The great variation in discharge is due to the fact that at times part of the flow is beneath the river surface and cannot be measured. Amistad Reservoir at conservation pool level (341 meters above sea level) almost reaches these springs.

The farthest downstream springs on the Devil's River which are still partially above the waters of Amistad Reservoir are the large **Slaughter Bend, Smith, and Swann-Shelton Springs (44)**, at latitude  $29^{\circ}40'$ , and longitude  $100^{\circ}56'$ . Located at the base of a limestone bluff on the east shore of the lake, they are most easily reached by boat. Burned-rock middens with numerous stone artifacts and pictographs have been found here. The discharge was 710 lps in 1921, 1,300 in 1925, 810 in 1928, and 310 in 1971 (before being partially covered by Amistad Reservoir waters). In 1976 only 110 lps of the flow was above the conservation pool level.



Location of the various San Felipe Springs.

Also deserving of mention are **Big Satan Springs (45)**, four kilometers west of Slaughter Bend Springs at the mouth of Big Satan Creek. They are interesting in that the flow of 3.4 lps issues from several openings in limestone precisely at the conservation pool level of Amistad Reservoir. Upstream in Big Satan Canyon may be seen a number of pictographs in rock shelters. **Lester Springs**, three kilometers south of Slaughter Bend Springs, are now beneath the lake surface. In 1928 they flowed 5.7 lps.

In southeastern Val Verde County, on Carl Yoas' ranch, are **Yoas Springs (46)**, at latitude  $29^{\circ}18'$  and longitude  $100^{\circ}46'$ . These springs have shown an increase in flow since Amistad Reservoir was completed in 1968. They were dry in 1955 and 1956, and flowed 3.1 lps in 1968 and 1976.

The fourth largest springs in Texas, **San Felipe Springs**, are a group of ten or more springs which extend for about three kilometers along San Felipe Creek northeast of Del Rio. Their locations are shown on the accompanying map. The largest and best known are No. 1 through 3 on the San Felipe golf course. Water is pumped from No. 2 and 3 for the city of Del Rio and Laughlin Air Force Base. No. 4 is a former spring, now dry. No. 5 through 7 are upstream on the Lowe ranch, in a game preserve where foxes, skunks, red racer snakes, and countless deer may be seen. Burned-rock middens are also present. The water rises under artesian pressure through a fault in the rocks here. No. 8 through 10, the Head Springs, are on Charlie Hinds' ranch. The largest of these rises from a hole 16 meters in diameter and 6 meters deep. A large Indian village once stood here. Dark gray soils indicate that there was once a large bog surrounding these springs, teeming with wildlife. It has since been drained, but many large fish survive in all of the springs.

Probably Gaspar Castano de Sosa was the first European to use the water from San Felipe Springs, in 1590. In the seventeenth and early eighteenth centuries many other Spanish explorers and settlers became acquainted with the springs. The Old Spanish Trail from San Antonio to El Paso came this way. In 1849 Lt. S. G. French described the springs as follows:

The road crosses this stream a little way below its head-waters. To the north of the road, and a half mile distant, there is a beautiful spring of water, fifty feet in diameter at the surface, the sides of which incline towards a centre, like an inverted cone, and then, sinking in a cylindrical form to the depth of twenty-eight feet, through a soil of hard clay, afford a passage for the water to rise. The water comes to the surface with slight ebullition, and flows off in a volume that would fill a cylinder