

Historical observations of hydrogeology in Texas— The 1850 report to the U.S. Senate by the Corps of Topographical Engineers

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Introduction

Texas has changed. As European explorers explored, settlers settled, and populations populated (and grew), Texas changed. The landscape changed with the introduction of new fauna and flora, and the hydrology changed with the landscape and with pumping and agriculture. Early explorers and survey teams saw Texas closer to its natural state, before non-Native Americans altered the landscape. Fortunately, many of these explorers and survey teams documented their observations in great detail—observations that are useful for modern studies of water resources.

In 1849, the Corps of Topographical Engineers—a group that was part of the Army but separate from the Corp of Engineers—surveyed part of Texas in search of a suitable road and railway path for commercial and military purposes between central Texas and El Paso. In addition, the California gold rush was on, with the 49ers seeking safe passage through West Texas. Sufficient water for man and beast was critical for traveling through the western part of Texas, west of the 100th meridian, especially on the High Plains. Given that one could travel about 15 to 30 miles a day by horseback, frequent water stops were required. These soldiers and their parties braved rattlesnakes, drought, snow storms, blue northers, and scalpings to explore central and west Texas—and they vividly reported their observations and thoughts about their travels across Texas.

The purpose of this paper is to summarize the observations of a number of surveys across Texas made in 1849 by Lieutenant Colonel J.E. Johnston, Lieutenant W.F. Smith, Lieutenant F.T. Bryan, Lieutenant N.H. Michler, and Captain S.G. French of the Corps of Topographical Engineers. The surveys include a number of informative—and often colorful—observations concerning the landscape, rivers, and springs of Texas. Of particular interest to the hydrogeologist is the description of pre-development conditions of the rivers, springs, and landscape. These descriptions offer clues as to how the hydrologic system may have been before invasive phreatophytes and pumping changed groundwater flow and its interaction with springs, streams, and rivers. This is of interest to conservationists, biologists, historians, hydrologists, and hydrogeologists—including modelers interested in simulating predevelopment conditions of an aquifer.

To compile these observations, I read “Reports of the Secretary of War with Reconnaissances of Routes from San Antonio to El Paso” published on July 24, 1850, and delivered by the Secretary of War to the 31st Congress (Figure 1; Johnston and others, 1950) and noted any description of water, springs, and the landscape. The document also included a map of the paths followed by some of the surveys. Using historic maps by DeCordova (1849) and Grant (1885) allowed me to identify features that had different names in 1850 than at present. Brian Hunt prepared a map with most of the place names mentioned in this paper for reference (Figure 2). Finally, I summarized the hydrogeologic observations of each survey with selected quotes from the reports. To add context to these observations, I have also summarized the history of the Corps of Topographical Engineers and the corps’ activities in Texas. Some of the quotations have a number of misspellings or have an archaic spelling of a word. Rather than impeder the flow of the text with numerous “sics,” I have left them as is. I tried to ensure that the quotes are as accurate as possible.

The Corps of Topographical Engineers¹

The Corps of Topographical Engineers² started in 1813 as part of the Corps of Engineers in anticipation of war with England. In 1838, the Corps of Topographical Engineers was separated from the Corp of Engineers as its own entity. Projects were divided between the two where the Corps of Topographical Engineers assumed the civil projects of the War Department such as river and harbor improvements. Later the topographical engineers also built lighthouses in various parts of the country and repaired roads in Washington, D.C. As their name suggests, they also collected topographical as well as geographical information of the United States.

Because they were part of the War Department, they also fought in wars, including the Mexican-American War (1846–1848), where two thirds of the engineers served. In 1863, during the Civil War, the commanders of the two corps recommended to Congress that the two corps be combined once again as the Corps of Engineers.

The Corps in Texas

Ten years after declaring independence from Mexico, Texas joined the United States in 1846. Disagreements over Texas’ border immediately resulted in the Mexican-American War, the result of which fixed Texas’ border at the Rio Grande. After the war ended, the United States was concerned that Mexico might attempt an invasion of Texas. Because the western part of the state, with the exception of the El Paso area, was relatively unsettled and, therefore, relatively unknown, the Corps of Topographical Engineers was ordered to map the area to find the best trails from San Antonio and other parts of Texas to El Paso. Skirmishes with Native Americans were another concern that could be better addressed with a survey of the western part of Texas. Finally, mapping trails across Texas would likely promote additional settlement, another way to tame the land, reduce the potential for a Mexican invasion, and control the Native Americans.

¹ The information in this section is primarily from Robinson (1931).

² Also referred to as the Bureau of Topographical Engineers and Topographical Bureau.

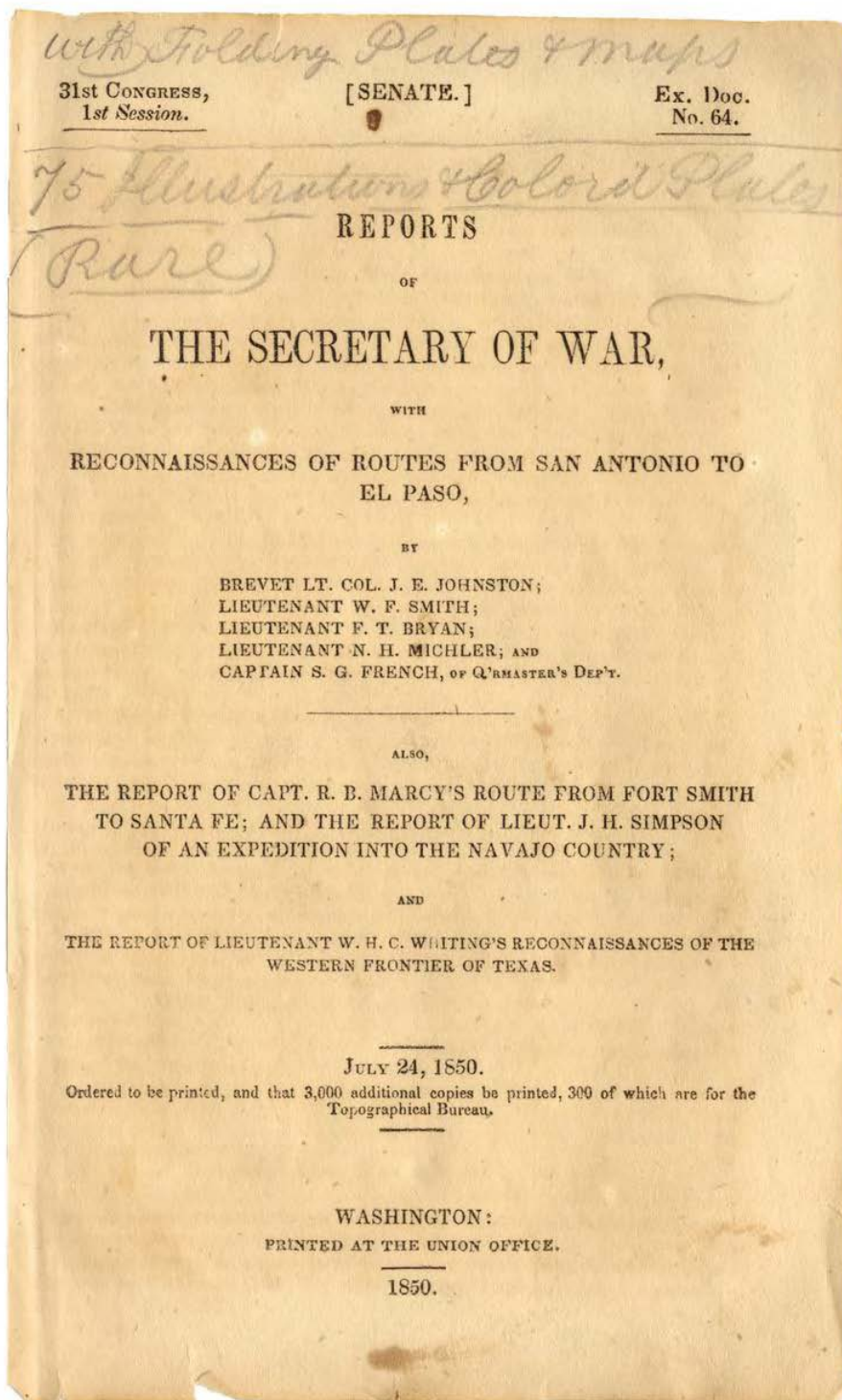


Figure 1. Title page of the report.

The 1850 Report

On July 24, 1850, the Corps of Topographical Engineers printed 3,000 copies of a report to the 31st Congress titled “Reports of the Secretary of War with Reconnaissances of Routes from San Antonio to El Paso.” As indicated in the cover letter from Colonel J.J. Abert, the collection of reports included the following survey reports:

- a report of a reconnaissance of a route for a road from San Antonio to El Paso by Lieutenant W.F. Smith, dated May 25, 1849;
- a report of a reconnaissance of the country between Corpus Christi and the military post on the Leona by Lieutenant N. Michler, dated July 31, 1849;
- a report of a reconnaissance of a route from San Antonio, via Fredericksburg, to El Paso, to obtain information in reference to a permanent military road from the Gulf of Mexico to El Paso by Lieutenant Frs. T. Bryan, dated December 1, 1849;
- a report of a reconnaissance of a route from the upper valley of the south branch of Red River to the Rio Pecos by Lieutenant N. Michler, dated January 28, 1850;
- a report of a reconnaissance of a route for a military road from San Antonio to El Paso by Captain S.G. French, dated December 21, 1849; and
- a report of a reconnaissance of a route from Fort Smith to Sante Fe by Captain R.B. Marcy, dated November 20, 1849.

Other reports, not discussed in this paper, involve investigating a pass through the Sacramento Mountains, a brief report from Colonel J.E. Johnston concerning the trails from San Antonio to El Paso, and a report by Lieutenant Colonel J.E. Johnston on the condition of the Colorado River and how to improve navigation on the river.

Smith’s Report—San Antonio to El Paso

Second Lieutenant W.F. Smith and Lieutenant J.E. Johnston and their party traveled from San Antonio to El Paso seeking a safe route of passage. They first traveled to Fredricksburg and camped at the headwaters of the San Pedro River along the way. From Fredricksburg, they headed to the headwaters of the San Saba River before ascending to the Edwards Plateau: “[We]... travelled for about one hundred and ten miles in a direction somewhat south of west, without finding even water-holes, and being occupied three days and a night in taking that distance.” This path over the plateau did not hold much promise as a viable road: “Though this country, for the distance of a hundred and twenty four miles, was such as to require no labor in advance of the wagon train, yet the great want of water caused us to consider the route as impracticable, except at the enormous expense of digging wells along it.” Their path over the plateau—through modern-day Schleicher and Crockett counties—took them to the headwaters of Live Oak Creek, a tributary to the Pecos River.⁵ They then traveled to Comanche Springs, known at that time by their Indian name, Ahuache Springs.

⁵ The Pecos River was sometimes referred to as the Rio Puerco.

In describing a southern route from San Antonio to El Paso via the Rio Grande, Smith and Johnston visited Las Moras springs and described San Felipe springs: “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 two feet in diameter. This spring is the source of the San Felipe; as it flows on, the volume of its waters is increased by other large springs, on either side, until it becomes a creek, when it empties into the Rio Grande, eight miles below the crossing, some thirty feet wide and several feet deep.” Traveling further west, they describe descending from probably the Delaware Mountains, finding a spring—probably from the Capitan Reef Complex aquifer—and a saline spring in the salt flats.

Michler’s Report—Corpus Christi to Leona

Second Lieutenant N. Michler, Jr., and Major G. Deas reported on an excursion from Corpus Christi to a military post on the Leona River. There is not much of hydrogeologic interest reported during their trip, but they do make observations concerning the landscape. For example, they note that the prairie near San Patricio is “...is covered with fine mezquite grass, and interspersed with mezquite trees and live-oak moats.” Near the confluence of Spring Creek with the Nueces River, they crossed at a ford of “...solid limestone...of sufficient breadth for several wagons abreast...” They described the flora at this ford as “[p]erfectly clear prairie, free from all lumber, bordering immediately upon the river at this point. Above and below, at a short distance from the ford, the timber in the bottom was heavy and thick, consisting of the elm, cottonwood, oak, &c., and covered with a dense growth of weeds.”⁶

Michler and his party described the Leona River when they crossed it: “The Leona is a beautiful stream of excellent water—limestone. The banks are nearly upon a level with its surface. It possesses a hard gravel bottom—its width about thirty, and its depth not more three feet, and flowing with a gentle current. It is said never to rise above its present level—the stream not being of sufficient length to be affected by heavy rains. The land immediately along the river is rich, and covered with heavy timber. A few hundred yards below the ford are fine falls, and the river not more than twelve feet in width.”

Bryan’s Report—San Antonio to El Paso via Fredricksburg

First Lieutenant Francis T. Bryan and Lieutenant Col. J.E. Johnston reported on their 46 day trip from San Antonio to El Paso via Fredricksburg. They mention stopping at Post Oak Springs, Pecan Spring, and Potato Spring near Kickapoo Creek. They reached the Pecos River and describe it as a “...muddy stream, of a dark red color, and, running through the plains, has very much the appearance of a canal.” They crossed the Pecos River at “Horse Head Crossing,” so named because of “...the number of horses’ heads which lie scattered near.” As they followed the Pecos River upstream, they found saline water holes and efflorescence. They approached the

⁶ “&c.” is an abbreviation of “et cetera”

Guadalupe Mountains and described arriving at Ojo del Cuerpo⁷, a spring of brackish water smelling of sulphur in the open prairie. They stopped at the tanks of Connados del Alamo, noting that “[w]ater issues from the rock in several places. Outside of the mountain, several wells have been dug by California parties. These wells were full when we passed. Inside the mountain, in a cavern, there is a fine large well of pure water; this is full to overflowing; the water is very cold and of good flavor.” Passing over the Hueco Mountains (spelled “Waco” in their report), they stopped at Hueco Tanks, noting that “[t]he tanks are situated in caves of large masses of granite rock. There are several of these tanks containing immense quantities of pure cold water.”

Michler’s Report—Red River to Rio Pecos

Second Lieutenant N. Michler, Jr. led an expedition from the upper valley of the south branch of the Red River (starting in Fort Washita on the Washita River in modern-day Oklahoma north of Grayson County⁸) to the Pecos River. Leaving Fort Washita on November 9, 1849, he noted that “...[t]he first two miles was through the Washita bottom; the soil rich, red clay mixed with sand, being excellent cotton land; the timber cottonwood, hickory, dogwood, elm, sycamore, and post oak.” He also noted that “[t]he water is of a bright vermilion color, and its taste brackish.” Upon reaching the Red River, Michler noted that “[t]here was some fine large and heavy timber upon the bank of the river—hackberry, mulberry, cottonwood, Spanish oak, black-jack, and willow forming the principal growth. The grazing near the river is, however, extremely bad.” He noted, in traveling west along the Red River from the confluence of the Washita River with the Red River “[t]he further west we travelled, the better grazing we found—the gramma, sedge, and buffalo grass the most abundant, but the mezquite constantly becoming more frequent.”

On the trip from the Red River to the Little and Big Wichita rivers (now referred to as the North and South Wichita rivers), Michler notes that “[n]ear the Red river the soil is slightly sandy, and you meet with some few post Oak mots. It then becomes a fine mezquite country, well timbered with mezquite, and for miles perfectly level; and even when a rolling prairie, the elevations and depressions are small. The grass at first is principally gramma, and the ordinary sedge, and their species; but then come the fine early mezquite and the winter mezquite. The whole extent was well watered by numerous branches of the two Wichitas. The country appeared to have been flooded by previous heavy rains, and numerous water holes were met at short intervals. Most of the streams possessed a slightly brackish taste: all of them were well timbered.” Of the Big Wichita River, he notes that “[t]he water is of the same color as that of Red river, and tasted very brackish and bitter; young cottonwood seems to be the only timber which grows along it. Within a few yards of its banks you find many lakes or ponds, the water of which is much more agreeable to the taste. The Indian name for this stream is “Ah he we wo nah:” translated into English, it signifies “Pond creek.””

As Michler continued south, he noted that one approaches “...the Brazos without the slightest indication of its presence. No timber along its banks as far as the eye can see: you stumble upon it without any forewarning. High bluff banks along its very edge conceal it, until you reach the top of them. Its channel is about fifty yards in width, and bounded but by a small strip of bottom

⁷ Spanish for “eye of the body.” Many springs are referred to using the Spanish word “ojo.” Also referred to as Ojos del Cuervo or Ojo del Cuerbo.

⁸ Cordova’s (1949) map shows the river as the “False Washita River” with Fort Washita in Oklahoma. There is a Washita River in modern-day Roberts and Hemphill counties.

land.” He noted that the water of the Brazos River was brackish, although small side streams of fresh water empty into the river.

Michler’s entourage continued south across the Clear Fork and Double Mountain Fork of the Brazos River. He noted that “[t]here was but little timber upon these streams upon first leaving the main fork; but the further we advanced the more we found elm being the principle growth. The whole country was well timbered with mezquite, but most of it had been killed by prairie fires.” In crossing the divide between the Brazos and Colorado river basins, Michler noted that “[t]he country here undergoes a complete change. You now meet with high rolling prairies, arid, and destitute of timber, and scarcely any grass but of the most miserable kind.”

Upon reaching the Colorado River, Michler’s party camped at the “Big Springs of the Colorado,” near modern-day Big Spring: “These springs are very large, and a considerable quantity of water is obtained from them; they cover a space of about twenty feet square, and in some places the water is fifteen feet in depth by measurement. They are walled in by a ledge of high rocks, forming a concave surface, within which the basin of the springs lies. The water is impregnated with lime, and is cool, fresh, and perfectly clear. It is carried away in a bold, running stream, which in a short distance sinks below the surface.”

Traveling west from the big springs, Michler approached Mustang Springs:⁹ “There was nothing to indicate their presence; a few scattering chaparral bushes were growing within half a mile of them, but in proximity to the water were no trees or bushes of any kind. A low prairie of about a hundred acres in extent, in form very nearly circular, and bounded by low bluffs, composed principally of white limestone, contains several small ponds of water, one or two pretty deep, and the rest not containing much water. The taste of the water is flat and sweet, being slightly brackish. From the number of trails leading to there, and the number of mustangs which came to water there, and the quantity of flag and other vegetable matter growing in and about them, I judge the water to be permanent. Several springs were found bubbling up in the ponds.”

From Mustang Springs, Michler and crew moved on to the sand hills: “Upon reaching the sand hills, we found, for the first twelve miles, low ridges of sand, running parallel to each other, plaids of the same kind interspersed between them, with small hillocks. The sand was here of a black color. Then come the white sand hills, which are really an object of curiosity. They are a perfect miniature Alps of sand the latter perfectly white and clean: in the midst of them you see summit after summit spreading out in every direction, not a sign of vegetation upon them nothing but sand piled upon sand. They form a belt two or three miles in width, and extend many miles in a northwest direction.” They also found water: “But a matter of the greatest surprise is to find large water holes among them: they are found at the base of the hills, are large, deep, and contain most excellent water, cool, clear, and pleasant. The water is permanent. A great deal of vegetable matter and young willow trees are found on their banks. This was the first water we found since leaving the Mustang spring a distance of sixty seven miles without any: during this entire distance we saw no indications of any whatever.”

Finally, on December 30, 1849, Michler reached the Pecos River. He noted that “[t]he course of the stream was nearly east and west; its width was about forty feet; and, being too deep to ford, we encamped on its left bank. It answered well the description given me by others, and was truly a “rolling mass of red mud” nothing to indicate its presence but a line of high reeds growing

⁹ Noted as “Mustang Fountain” on Grant’s (1885) map.

upon its banks. Along its banks you find numerous lakes, the water of which is clear, but still more brackish than even that of the river.” Michler followed the Pecos downstream to Horse Head Crossing and continued to San Antonio.

French’s Report—San Antonio to El Paso

Captain S.G. French also made the trip from San Antonio to El Paso by way of the Rio Grande on the “southern route” and returned to San Antonio via Fredricksburg on “the northern route.” He describes visits to San Lucas Springs, Las Moras Springs, San Felipe Springs, Pallas Blancas Springs, Howard’s Springs, Comanche Springs, Ojo de Leon springs, Eagle Springs, Ojo de los Alamos springs, and Thorn’s springs.

On his trip along the southern route to El Paso, French noted that “[t]he road from San Antonio to Castroville runs through a generally level prairie, covered with a luxuriant growth of grass; the soil is good, and country well adapted to cultivation and grazing.” At the time they traveled, late in May of 1849, the Medina River flowed but Hondo, Seco, and Quihi creeks were dry. He described the Sabinal River as “...a clear, cool, delightful, running stream, with banks bordered with large trees, suitable for building purposes.” He further notes that upon “[l]eaving the Sabinal [River], the country is more rolling and diversified; the growth of small mezquite bushes begins to take the place of the open prairie.”

Moving farther west, French found the Frio River dry and the Leona River flowing. Of the Leona and Nueces rivers, he wrote poetically: “The Leona—a clear, cool, and beautiful stream has its source in this neighborhood, and forms, in the course of a few miles, a creek some fifty feet wide, flowing through a dense forest, on either side a quarter of a mile in width. The lands on this stream will vie in fertility with any portion of Texas; and the abundance of timber scattered over the whole extent of the Nueces adds much to its value. No part of the State offers greater inducements to the agriculturist, and as a grazing country it is unrivalled.” Further on, he notes that the Nueces River flowed 40 feet wide and one and a half feet deep.

French and his party stopped in at Las Moras River, “[i]ts waters, gushing out from the springs, form at once a large creek. Trees line its banks as far as the eye can reach.” He then crossed Piedra Pinta Creek, now Pinto Creek, and noted that it flowed at the time.

After crossing several more creeks, French reached San Felipe Springs. He described San Felipe Springs as “...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 two feet in diameter. This spring is the source of the San Felipe [River]; as it flows on, the volume of its waters is increased by other large springs, on either side, until it becomes a creek, when it empties into the Rio Grande, eight miles below the crossing, some thirty feet wide and several feet deep.”

French noted that beyond this point, the land changed, that San Felipe Creek represented “...the last of those small, clear streams, flowing through fertile valleys, with banks admitting every access to their waters.” North of this area, moving upstream on the Rio Grande, the river was bordered by “the great table formation,” the Edwards Plateau. French later refers to San Pedro

Creek as "...a stream about sixty yards wide, running over a level bed of solid limestone rock." However, he was probably referring to the modern-day Devils River.¹⁰ Moving up onto the tablelands, French noted "...some springs sunk in the open plain at and near Pallas Blancas."¹¹ Returning to San Pedro Creek and following its course downstream, French noted that "...the country is a constant succession of hills on hills, destitute of grass and wood, and giving support only to the saw-leaf palmetto. It is a miserably rough, broken, and barren region, avoided alike by every living thing."

Continuing along the plateau toward the Pecos River, French and his party came upon Howard's Springs. Of Howard's Springs, French notes that "[t]he springs, from the large basin they form, afford a small stream of running water in the summer, which, after flowing a short distance, sinks into the ground." Upon reaching the Pecos River, French noted that "[t]he Pecos is a remarkable stream, narrow and deep, extremely crooked in its course, and rapid in its current. Its waters are turbid and bitter, and carry, in both mechanical mixture and chemical solution, more impurities than perhaps any other river in the south. Its banks are steep, and, in a course of two hundred and forty miles, there are but few places where an animal can approach them for water in safety. Not a tree or bush marks its course; and one may stand on its banks and not know that the stream is near. The only inhabitants of its waters are catfish; and the antelope and wolf alone visit its dreary, silent, and desolate shores. It is avoided even by the Indians."

As French moved west of the Pecos River, he noted that "...the soil becomes more and more sterile, without grass, and yielding support to nothing but dwarf bushes, Spanish bayonets, and stunted cactus." About 18 miles west of the Pecos, at Escondido Creek, he found "...water...in ponds, some of them quite deep, surrounded by a tall growth of rushes and cane. The water rises from a rocky bottom, and, as it imperceptibly glides away, gives life and freshness to the coarse grass and cane."

French then visited Comanche springs and observed that "[t]he water rises from a number of springs, and forms a stream of excellent water, perhaps twenty feet wide and two feet deep, which, after flowing some ten miles, disappears in a salt plain." He then traveled to springs at Ojo de Leon, noting that "[t]he water rises to the surface from out of springs, thirty or forty feet in diameter, that sink to a great depth, like large wells. The water runs from one spring to another, and finally, in the course of a half mile, sinks into the earth. Near the springs the ground is bare, and covered with a finely crystallized salt, which at a distance appears like snow. The odor of sulphur is perceptible about the springs."

On the 40-mile trip to Limpia Creek, French notes that one cannot count on finding water along the way. Where the road crossed Limpia Creek, the stream was flowing, although it appeared upstream of the road and disappeared a short distance downstream of the road. It had apparently been a wet summer, since he noted that "[t]he hills were here, in August, clothed in verdure as green as if it were early spring. The country is beautiful; and the mountains, covered with green grass to their summits, present a pleasing appearance."

French found little water between Limpia Creek and Eagle Springs. He found water at Smith's run, a flowing creek sourced in the mountains. He found more water at a spring 10 miles up the road. After that, it was 60 miles to Eagle Springs "...found in a ravine formed by the spurs of the

¹⁰ There is a modern-day San Pedro Creek tributary to the Devils River.

¹¹ I was not able to discern the location of Pallas Blancas.

mountains.” French described the springs as oozing out of the ground into numerous dug holes. From here, French’s entourage traveled to El Paso which, at the time, was located on the Mexican side of the Rio Grande with only three houses on the United States side. French described the plants and agriculture in the area as well as the possibility for growth. He noted that “[t]he valley of the Rio Grande, in proper hands, is capable of supporting a large population; and...the larger portion is on the American side.”

On his return trip to San Antonio, via the northern route, French first passed by Waco Tanks, now spelled Hueco Tanks, and noted that “[t]he supply of water in these tanks depends on the rains.” The next water he found was at Ojo de los Alamos, which consisted of small holes dug into the side of the mountain. He noted that the holes would not supply enough water for 2,000 animals, but that more holes could be sunk. Thorn’s Springs appear nine miles up the road with water “in abundance,” but required the use of buckets to pull water “...from a natural well in a cave.” French found water at Ojo del Cuerpo (source not described) as well as at the heads of streams sourced from the Guadalupe Mountains. Meeting the Pecos River just south of its confluence with Delaware Creek, French followed the river downstream for 175 miles. During this part of the trip, French wrote that “...few places can be found more solitary, or that present a more dreary appearance, than all this region of the Pecos. The only sign of life or moving thing is now and then a single deer, a few antelope, a flock of ducks circling over the lagoons, or a solitary crane winging his way up the course of the stream.” He notes numerous salt marshes, salty quicksand—enough to mire animals, and bogs.

After this point, French concludes his report, referring the reader to the other reports that describe the trail from the Pecos River to San Antonio.

Marcy’s Report—San Antonio to El Paso

Captain 5th Infantry R.B. Marcy made a survey of the Canadian River en route from Fort Smith, Arkansas, to Sante Fe, New Mexico, noting various springs on his route. His travels west carried him across the modern-day Texas Panhandle. Marcy’s entourage traveled along the south side of the Canadian River. As they approach the Llano Estacado, he describes several streams of fresh water, probably Red Deer Creek and various creeks in Roberts County, features that still flow today fed by groundwater from the Ogallala Aquifer. On his trip, he vividly describes the Llano Estacado: “Leaving camp early this morning, we travelled two miles on our course, when we encountered a spur of the plain, running too far east for us to pass around under it; and finding a very easy ascent to the summit, I took the road over the plain. When we were upon the high table land, a view presented itself as boundless as the ocean. Not a tree, shrub, or any other object, either animate or inanimate, relieved the dreary monotony of the prospect; it was a vast, illimitable expanse of desert prairie the dreaded “Llano Estacado” [...]; or, in other words, the great Zahara of North America. It is a region almost as vast and trackless as the ocean—a land where no man, either savage or civilized, permanently abides; it spreads forth into a treeless, desolate waste of uninhabited solitude, which always has been, and must continue, uninhabited forever; even the savages dare not venture to cross it except at two or three places, where they

know water can be found. The only herbage upon these barren plains is a very short buffalo grass, and, on account of the scarcity of water, all animals appear to shun it.”¹²

While in Santa Fe, Marcy decided that he wanted to cross the Llano Estacado on the way back to Fort Smith and found a Comanche that told them that it was possible to cross the Staked Plains if one followed the proper trail—a trail with water. Marcy and his party traveled down the Rio Grande to Doña Ana, about 60 miles north of El Paso, before heading east past the Organ and Sacramento mountains before cutting down to the water hole at the Hueco Mountains. Because they were traveling in an area without much water, Marcy noted how the Mexicans traveled in the area: “The manner in which the Mexican traders slake these long stages, without water (and I believe it to be the best) is, before starting, to graze their animals from morning until about 3 p.m., give them all the water they will drink, then harness and start them immediately, and drive until 4 o'clock the next morning, when they stop three hours to graze while the dew is on the grass, and drive until it becomes hot towards the middle of the day; they then make another halt until 5 o'clock in the evening, when they start again and push through to the water. In this way fifty, sixty, or seventy miles can be made with loaded mule or ox wagons in the hottest weather of the summer.”

At the Hueco Mountains, Marcy stopped at what was probably Hueco Tanks, noting that they “...found a great abundance of good water in an immense tank up a ravine on the South mountain. This is a huge deep basin, scooped out of the solid rock with great symmetry and regularity, and of sufficient capacity to contain several hundred gallons of water.” Moving farther east, Marcy noted that “[u]pon the east side of the “Comudas” there is an arched entrance into a large cavern which is lighted from above, and in this we found a well fifteen feet deep, filled to the top with beautifully pure water; besides this we found water sufficient for our animals in tanks on the west side of the hill.”¹³ Heading in the direction of the Guadalupe Mountains, Marcy visits Ojo del Cuerdo, or Crow Spring. He noted that “[t]he spring is upon the open plain, and contains a large supply of water at all seasons; and, although it is sulphurous, yet animals are very fond of it, and we found it to answer, in the absence of better, for drinking and cooking.” From here, he crosses the salt lakes of the Salt Bolson.

Descending from the Guadalupe Mountains toward the Pecos River, Marcy’s entourage stopped at Independence Spring where they “...found two large springs of pure cold water, which boil up from the ground and run off in a stream about the size of a barrel...” They then stopped at Ojo de San Martín at the head of Delaware Creek.¹⁴ Marcy noted that the spring here “...bursts out of a solid limestone rock in a volume of sufficient magnitude to drive an ordinary saw-mill at the fountain-head, and is as pure, sweet water as I ever drank.” He also noted that there were a number of springs in the area: “Above [Ojo de San Martín] there are several others possessing different mineral properties. One is highly charged with sulphuretted hydrogen, and tastes very much like the Kentucky “Blue Lick water.” Another is decidedly chalybeate, and a, third is strongly sulphurous, leaving a thick incrustation of sulphur upon the rocks for many yards from the source. These unite in one common outlet, and the amalgamation is far from pleasant to the taste.” Marcy wrote about the resort possibilities of the area: “Is it not within the scope of

¹² I took out “of New Mexico” where [...] is within the quotation for clarity purposes and because I believe they were in Texas at the time, not to mention that much more of the Llano Estacado is in Texas rather than New Mexico.

¹³ This could be Thorn’s springs described by French.

¹⁴ Now known as Delaware Springs; also known in the past as Head Springs, Five Springs, and La Cienega (Brune, 2002).

probabilities that these springs may be found to possess valuable medicinal properties, and that this place may yet (and at no very distant period) become, a place of fashionable resort for the "upper-ten-thousand" of New Mexico? The climate here is delightful, the atmosphere perfectly elastic and pure, and the temperature uniform and delicious; then, may not an invalid derive as much benefit at this place as at Saratoga or any other of our watering places?"

Marcy next camped along the Pecos River. He persisted in his desire to cross the Llano Estacado, but was rebuffed by his guide: "Our Comanche guide informs me this evening that I cannot, as I desired, go directly from this point to the head of the Colorado or Brazos, as no man (not even an Indian) ever undertakes to cross the "Llano Estacado" opposite here." They continued down the Pecos River, noting that it was slightly brackish, but still usable. After crossing the river, they headed for the sand dunes in modern-day Ward County. Marcy noted that: "These hills, or mounds, present a most singular and anomalous feature in the geology of the prairies. They extend (so far as we have explored) at least fifty miles in nearly a north and south direction, and from five to ten miles east and west; they are white drift-sand thrown up with much uniformity into a multitude of conical hills, destitute of soil, trees, or herbage. In following up the trail from our road into the midst of this ocean of sand, we suddenly came upon several large, deep pools of pure water the very last place on earth where one would ever think of looking for it. We are told by our guide that water can always be found here in the driest season, and, judging from the rushes and other water plants growing in the ponds, I have no doubt that such is the case."

Finally, after leaving the sand dunes, Marcy got his wish to cross the Llano Estacado: "Leaving the sand this morning, we pushed out upon the high, plain of the Llano Estacado, not knowing whether we were to find water before we reached a laguna about sixty five miles distant. As our guide had passed over this portion of the road but once before, and then in a hurry, he was not very familiar with the localities. I therefore sent a party in advance to search for water, and felt some anxiety as to the result; I was relieved, however, about 11 o'clock, when a messenger returned with the cheering intelligence that the party had found a large pond of good water about sixteen miles from where we left this morning. This good news appeared to inspire our men and animals with renewed vigor. From the cheerless silence of the last two hours, the aspect of everything changed in a moment to humorous jokes and boisterous merriment. The whips were heard cracking from one end of the train to the other, and the mules appeared to move along with more ease than before."

Marcy's group passes several playa lakes that held water, including one he named Mustang Pond. He noted that "...it is thought there will be water at all seasons; it is about three feet deep, covers several acres of ground, and has rushes growing in it. There are also numerous trails made by mustangs leading to it, showing that it is much frequented by them; and as the horse requires water every day, he would not probably stay at a place where it could not be found at all times." They then reached the Laguna, or Salt Lake, before reaching Big Spring: "...we reached the border of the high plain, and descended an easy slope of about fifty feet to a bench below; here we could see two low bluffs in the direction we were marching, near which our guide informed us we could find a fine spring of water. Fourteen and a half miles' travel over a beautiful road brought us to the spring, which we found flowing from a deep chasm in the limestone rocks into an immense reservoir of some fifty feet in depth."

East of Big Spring, one of the scouts didn't return. Marcy sent a lieutenant to find the scout. "[the] [l]ieutenant...followed the track about two miles from where he was met by the Indians, to

a small branch of the Colorado, where, to his horror and astonishment, he suddenly came upon the murdered and mangled corpse of poor Lieutenant Harrison, lying down among the rocks, where they had thrown him, scalped, and stripped of all his clothing.” In a brutal reminder of the challenges of exploring Texas western realms, Marcy’s camp was stunned by the news: “When the melancholy news reached us that he had been murdered, there was such an expression of gloom cast over the command as I have never witnessed before. Old soldiers who had often seen their comrades falling by their sides in battle, and whose hearts, it might be supposed, were steeled against the manifestation of what some might consider weakness, were seen to turn away their faces to conceal their tears. They knew that in his death they lost a good friend.” They boxed up Lieutenant Harrison to carry him back to Fort Smith.

A little farther down the trail, Marcy and his group experienced a blue norther: “We have had during last night one of the most terrific storms I have ever witnessed in the whole course of my life. The wind blew a perfect tempest from the north, and it appeared as if the whole floodgates of the heavens were suddenly opened, and the accumulated rains of a year poured out in torrents for fifteen consecutive hours upon us. The whole surface of the earth was deluged; even upon the tops of the hills there were three inches of water, and it filled every ravine and hole about us. The creek upon which we are encamped had but very little water in it last night: it is now full to the top of its banks, and would float a steamboat.” From here, they cut north, to the east of the Llano Estacado, across the Colorado and the Brazos rivers, up to the Red River, and then east back to Fort Smith, Arkansas.

In all, Marcy and his group marched 2,023 miles in the course of six months. In his summary notes, he strongly recommended a railway, noting that “...the surface of the earth is so perfectly firm and smooth that it would appear to have been designed by the Great Architect of the Universe for a railroad...” once you got past the mountains. He also dreamed that the east and west coasts could be linked by railway that “...would give us a great national highway across our continent from the Atlantic to the Pacific, in a very direct line, and would enable the traveller to pass safely and comfortably over a distance in a week which before required four months of toil, hardship, and danger. It would afford our government a cheap and rapid transit for troops and munitions of war, and would enable us to communicate with our far distant territories in a few hours. These considerations, in connexion with the vast and incalculable commercial benefits that the whole civilized world would receive, would render it a monument to the genius, enterprise, and philanthropy of the American people.”

Clues of Early Hydrogeologic Conditions

When these officers of the Corps of Topographic Engineers traversed Texas, they saw the hydrologic system before pumping changed it. For example, Comanche Springs, which flowed amply in the mid nineteenth century, had dried up a little more than a hundred years later due to pumping (Brune, 2002; although ample rainfall in recent years has caused the springs to flow again). The Ogallala Aquifer used to feed a number of playa lakes in the southern part of the southern High Plains as well as some springs, such as Mustang Springs (referred to as Mustang Fountain on the Grant [1885] map). However, pumping dried up the springs in the 1940s (Brune, 2002), and the water table now sits 30 to 60 feet below land surface (TWDB, 2006).

Springs sometimes unwittingly invite their demise. Because drilling a water well was expensive, people drilling for water wanted to increase their odds of a successful well as much as possible. If a spring was flowing in an area, it was a good sign that the aquifer in the area could be productive. Therefore, many early wells were drilled near springs. This happened to Big Spring, which dried up sometime after 1900 after the railroad drilled and pumped wells near the spring to supply the growing town of Big Spring (Brune, 2002). Water levels in the aquifer beneath the spring—the Trinity part of the Edwards–Trinity (Plateau) Aquifer—were about 30 feet below land surface in 1990 and were reportedly more than 150 feet below land surface in 1936 (TWDB, 2006). Comanche Springs and Ojo de Leon (also referred to as Leon Springs), both in Pecos County, also fell victim to pumping. Crow Springs, or Ojo del Cuervo (also referred to as Ojo del Cuerbo and Ojo del Cuerpo), is now dry after an irrigation well was installed near the springs in 1948 (Brune, 2002). This spring, located in the salt flats, likely issued from the Bone Spring-Victorio Peak Aquifer, where water levels are now about 20 to 60 feet below land surface. Ojo de los Alamos, also referred to as the tanks of Connados del Alamo and Cottonwood Springs, issued from the Finlay Limestone and was flowing in 1960 but not in 1976 and later (Brune, 2002).

Las Moras and San Felipe springs, issuing from the Edwards equivalent rocks of the Edwards-Trinity (Plateau) Aquifer, continue to flow as does San Lucas Springs in Bexar County. Howard's Springs (also referred to as Howards Spring, Howard Spring, and Howard's Well) continues to flow in Crockett County. Ojo de San Martín, also referred to as Head Springs and Five Springs, and Independence Springs, in Culberson County still flow.

The observations of Ward County are interesting because they describe a number of springs in the area, even among the sand dunes. Ward County is underlain by the Pecos Valley Aquifer, an aquifer that has seen its water levels decline 50 to 100 feet in response to pumping. The pools of water noted by Captain Marcy continue to exist. Brune (2002) notes that they are fewer and shallower because of pumping of the aquifer to support oilfield operations. However, water levels in wells at the park are about 40 feet below land surface, suggesting that the ponds are not in direct contact with the Pecos Valley Aquifer and are instead fed with perched groundwater, perhaps from the dunes themselves.

Brune (2002) hypothesizes that the Pecos River in this area used to be gaining, which seems to be supported by the observations of the Corps concerning springs and swamps, especially near the river. Water levels in the underlying Pecos Valley Aquifer are currently about 50 feet below land surface near the Pecos River (TWDB, 2006). One well (46-37-401) near the river shows the decline of water levels with time where water levels were less than 2 feet below land surface in 1939 and were 20 feet below land surface by the late 1950s. The river, once a surprise on the plains, is now clearly marked with salt cedar, although there are currently efforts to eradicate this phreatophyte from the river's banks.

Conclusions

Surveys of Texas by the Corps of Topographical Engineers includes interesting and useful information about the predevelopment character of the hydrologic systems of West and Far West Texas. Because water was important to satiate the thirst of the people and animals on these surveys, water is prominently discussed. The surveys describe a number of springs, many of

which have since gone dry due to pumping in subsequent years. Descriptions of the Pecos River above the Pecos Valley Aquifer strongly suggest that the aquifer used to discharge to the river as well as a collection of swamps and bogs in the area. The surveys also note the lack of vegetation along this reach of the Pecos River as well as along the upper reaches of the Brazos River, suggesting phreatophytes were less prevalent in predevelopment and pre-settlement times.

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