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PRELIMINARY EXAMINATION OF BRAZOS RIVER, TEXAS, FROM THE CITY OF WACO TO THE TOWN OF RICHMOND.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., February 15, 1895.

GENERAL: In accordance with instructions contained in letter dated Office of the Chief of Engineers, U. S. Army, Washington, D. C., August 20, 1894, I have the honor to make the following report on the preliminary examination of "Brazos River, Texas, from the city of Waco to the town of Richmond."

This examination was made under my direction by Mr. S. W. Campbell, assistant engineer. He left Waco on January 4, and completed the examination to Richmond on February 5, 1895.

A survey of the Brazos River, from Waco to its mouth, was made in 1875 (see Report of the Chief of Engineers for 1875, p. 929 et seq.), and a report on a preliminary examination from its mouth to Waco was made in 1891 (see Report of the Chief of Engineers for 1892, p. 555 et seq.).

From reference to these reports and information gathered from the present examination the condition of the stream and its adaptability to improvement is as follows:

The Brazos River, Texas, from Waco to Richmond, a distance of 328 miles, flows in a southeasterly direction between high banks and over a much obstructed bed. At the time of the examination the river was at a very low stage, so much so that in many places it would not float a skiff.

The obstructions consist of rock ledges and sand and gravel shoals, and railroad and other bridges without draws.

No.	Nature of obstructions.	Distance from Waco.	Remarks.
		Miles.	
1	Suspension bridge	0	Span, 470 feet; elevation, 40 feet above river bed.
2	Cotton Belt Rwy. Bridge	0	Iron truss; spans, 125 feet; elevation, 35 feet above river bed.
3	Missouri, Kansas and Texas Rwy. Bridge.	0	Iron truss; spans, 150 feet; elevation, 35 feet above river bed.
4	Rock Dam	30½	Gravel shoal ending in rock ledge; fall, 2 feet.
5	Falls of the Brazos	43½	Rock shoal with rapids; total fall, 6½ feet
6	Upper Blue Shoal	51	Gravel shoal, followed by bed of limestone 300 yards long.
7	Lower Blue Shoal	58½	Similar to above; one-half mile long.
8	Curleys Shoal	72	River blocked by loose rock and bowlders 8 to 10 feet high.
9	Calvert or Cannon Ball Shoal	75	Length, one-half mile, and obstructed by bowlders.
10	Wagon bridge	.....	1 span, 175 feet; elevation, 30 feet above river bed.
11	Herndens Shoals	77	2 miles long; river bed entirely obstructed by loose rock and bowlders.
12	Pat Sullivan Shoals	86½	Rock shoal with 3 separate falls of 1 foot each.
13	Wagon bridge	87	3 spans of 125 feet each; elevation, 30 feet above river bed.
14	International and Great Northern Rwy. Bridge.	.....	1 span of 150 feet and one of 75 feet; elevation, 40 feet above river bed.
15	Neblins Shoal	112	One-fourth mile long, with fall of 1 foot.
16	Williams Shoal	.....	Rock shoals and rapids; fall, 2 feet.
17	Munsons Shoal	121	Rock shoals and rapids; total fall, 4 feet.
18	Wagon bridge	.....	1 span of 160 feet and 2 of 112 feet; elevation, 30 feet above river bed.
19	Gulf, Colorado and Santa Fe Rwy. Bridge.	.....	Iron truss; 2 spans 150 feet each; center pier on sand bar in river; elevation, 30 feet.
20	Hidalgo Falls	167	Rock ledge with bowlders; fall, 4½ feet.
21	Wagon bridge	.....	1 span of 100 feet and 2 of 75 feet; elevation, 30 feet.
22	Gates Ferry	195½	Rock ledge.
23	Houston and Texas Central Rwy. Bridge.	.....	Iron truss; 3 spans 150 feet each; elevation, 30 feet.

No.	Nature of obstructions.	Distance from Waco.	Remarks.
		Miles.	
24	Cochrans Shoals	226½	Rock and gravel shoal; fall, 3½ feet.
25	San Filipe Shoal	266½	Rock shoal.
26	Rock shoal	270	Rock ledge, with fall of 2½ feet.
27	Texas Western Rwy. Bridge	272	1 span of 150 feet, and approaches; elevation, 30 feet.
28	Missouri, Kansas and Texas Rwy. Bridge.	274	2 spans 150 feet each and 1 of 75 feet; elevation, 30 feet.
29	San Antonio and Aransas Pass Rwy. Bridge.	.....	2 spans 112 feet each; elevation, 40 feet.
30	Ferris Shoal and Fall	324	Rock shoals and rapids; fall, 3 feet.

NOTE.—Depth of water on shoals at time examination was made varied from 2 to 8 inches.

Between the above obstructions numerous small shoals and gravel bars as well as snags were found.

The fluctuations of this portion of the river between high and low water is about 15 feet, but no data is accessible to determine the duration of high or low water.

There being no towns along the river from Waco to Richmond, it was impossible to obtain a statement of the commercial statistics of that portion of the river. The principal products are cotton and corn. The Commercial Club, of Waco, was having the statistics compiled and promised to forward the statement to this office and it will be forwarded as soon as received.

The only method of improving this stream to admit of low-water navigation would be by means of locks and dams. The fall from Waco to Richmond is over 300 feet and this method of improvement would require an expenditure of probably $3,000,000 to $4,000,000. Even if such expensive works were contemplated it is very doubtful if a sufficient water supply could be obtained to render the locks available at low water.

In view of the great cost, in my opinion this stream is not worthy of improvement.

Very respectfully, your obedient servant,

A. M. MILLER,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Lieut. Col. H. M. Robert, Corps of Engineers, Division Engineer, Southwest Division.)

[First indorsement.]

U. S. ENGINEER OFFICE, SOUTHWEST DIVISION,
New York, February, 28, 1895.

Respectfully forwarded to the Chief of Engineers.

For the reasons given by the district officer I am of opinion that the Brazos River, from Waco to Richmond, is not worthy of improvement by the United States.

HENRY M. ROBERT,
Colonel, Corps of Engineers, Division Engineer.

REPORT OF MR. S. W. CAMPBELL, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., February 9, 1895.

MAJOR: In accordance with your instructions of January 2, 1895, I left Galveston for Waco on the 4th, arriving there that night, and made the trip from Waco down to Richmond in a 14-foot skiff with one man to help me, and accompanied by two men in a boat sent by the Commercial Club, of Waco, to see that I made the trip through. These men were not employed by me, nor were they at any expense to the Government.

The river banks vary from 30 to 50 feet in height, and the bed from 350 to 500 feet in width, with a very large volume of water in it during the wet seasons, but now nearly dry owing to the long drought.

There are no towns on the river between Waco and Richmond, but many farms and plantations, the people living from 1 to 2 miles away from river banks.

The products are cotton and corn, of which a great deal is raised. I could not obtain any statistics in regard to the products, as the owners of these places live in the towns 4 to 10 miles from the river, only negroes living on the farms.

I was very much delayed by the low stage of the river, making it necessary to walk and drag the boat a great deal of the time; also had very bad weather—rain, sleet, and cold nearly all the time, so did not arrive at Richmond until February 5.

The river was found to be at an unusually low stage (said to be the lowest for thirty years). For the first 40 miles the depth of water was not sufficient to float a skiff with two persons in it.

The banks vary from 20 to 50 feet in height and in width the river is 500 feet at Waco, and narrows down to about 300 feet.

At Waco there are three bridges crossing it—a suspension bridge of 470 feet with lower cords 40 feet above bed of river, and the Cotton Belt Railroad and the Missouri, Kansas and Texas Railroad bridges, the spans of which are 125 and 150 feet each, and the lower cords are 35 feet above bed of river.

The obstructions to navigation in the first 40 miles are very slight shoals, with the exception of "Rock Dam," which, at an ordinary stage of the river would not be noted.

Just below "Horse Shoe Bend" the river has cut a new channel through a bend. This is said to have been done in the last four years.

"Rock Dam," 30¼ miles below Waco, commences with a gravel shoal one-fourth mile long; then the river is dammed up by limestone rock and bowlders for 200 feet, with a fall of 2 feet. Between "Rock Dam" and Brazos Bridge, near Marline, is a gravel shoal. There is a sand bar in the river under the bridge. The bridge is two spans of 150 feet each and approaches; elevation, 40 feet above river bed.

Falls of the Brazos, 43½ miles below Waco, is a very serious obstruction. The shoals are of soft limestone for 1 mile, with a ledge extending diagonally across the bed of river and an abrupt fall of 3½ feet; then rapids for one-half mile, with two falls of 1½ feet each, and ending with a sand and gravel bar 500 feet long, 125 feet wide, and 5 feet high. The water flows over this shoal through the crevices in the rock, and is only 2 to 6 inches deep at the present stage of river.

Upper Blue Shoal, 51 miles below Waco, commences with a gravel shoal 300 yards long; then the river flows over a bed of soft limestone with pieces of sandstone scattered about it, the water flowing through many little crevices. There are snags in the river between this and Lower Blue Shoals.

Lower Blue Shoal, 58¼ miles below Waco, is similar to the above, and is one-half mile long.

Between Lower Blue Shoal and Curleys Shoals there are three gravel shoals and rapids, with snags and drift lodged in many places.

Curleys Shoals, 72 miles below Waco, is a very serious obstruction. The river is blocked up with loose rock and bowlders in many places 8 to 10 feet high, while a narrow channel is obstructed by lime and sandstone bowlders of 5 to 30 tons.

Calvert or Cannon Ball Shoal, 75 miles below Waco, is a half mile long. The river is obstructed by round bowlders of 1 to 5 tons, and just below is a wagon bridge of one span of 175 feet and approaches; elevation 30 feet above river bed.

Hirndens Shoals, 77 miles below Waco, are 2 miles long. The river bed is entirely obstructed by loose rocks, bowlders, and ledges of lime and sandstone; lignite along right bank. A great mass of drift lodged on this shoal; had to have boat carried around this place by a wagon, as it was found to be impossible to take it across. Two and a half miles below this shoal is a dam of logs and rock across the river, said to have been built by a fisherman. Had to cut through the dam with an ax. A slight rock shoal in the river at this place. Between this and Port Sullivan Shoal there are two small rock shoals; rock just to water's surface.

Port Sullivan Shoals, 86¼ miles below Waco, is the most serious obstruction of any, beginning with a ledge of limestone across the bed of the river and several

ledges of limestone in its bed. The river is obstructed by large lime and sandstone bowlders for three-fourths of a mile. There are three separate falls of about 1 foot each, ending with a gravel shoal, and a wagon bridge across river of three spans 125 feet each; elevation, 30 feet above bed of river.

Between Port Sullivan and the International and Great Northern Railroad Bridge is a gravel shoal. The bridge has one span of 150 feet and one of 75 feet; elevation 40 feet above the bed of the river.

Between the International and Great Northern Railroad Bridge and Niblins Shoals are two sand and gravel shoals and two slight rock shoals, with rock just to water's surface, also snags in the river.

"Niblins Shoals," 112 miles below Waco, extends for one-fourth of a mile with a fall of about 1 foot. Not noticeable at ordinary state of river.

"Williams Shoals," below Little Brazos River, are rock shoals and rapids with one fall of 1½ feet and one of one-half foot. Snags in the river for 300 yards below.

Munsons Shoal and Rapids, 121 miles below Waco, is 1 mile long, over a bed of soft rock and a great deal of petrifaction along the bed of the river. There is an abrupt fall of 2 feet, and a total fall from beginning to end of shoal of about 4 feet approximately.

Between Munsons Shoal and the Gulf, Colorado and Santa Fe Railroad Bridge (Navasota branch) is a wagon bridge of three spans, one of 160 feet and two of 120 feet each; elevation 30 feet above bed of river. There is a gravel bar in the bed of the river, one gravel shoal, and two small rock shoals, also an island of rock and sand 4½ miles above the Gulf, Colorado and Santa Fe Railroad Bridge, with a good channel on both sides.

The Gulf, Colorado and Santa Fe Railroad Bridge (Navasota branch) crosses the river 1½ miles above Yegua Creek. The bridge is an iron structure of two spans, of 150 feet each. The center pier is on a sand bar in the river. The elevation of the lower chords is 30 feet above the bed of the river. Old piling (false-work piles) obstruct the river. There are a great many snags 300 yards above the bridge and a slight rock and gravel shoal 300 yards below.

Between the Gulf, Colorado and Santa Fe Railroad Bridge and Hidalgo Falls are Hoxies Rocks, a ledge extending three-fourths way across the river bed with snags and drift in river. Eight miles below is a narrow ledge of rock across the bed of the river at the water's surface.

Hidalgo Falls, 167 miles below Waco, is a very serious obstruction, the river flowing over the rocks for 500 yards; there are several ledges of rock and also large bowlders in the bed of the river. An abrupt fall of 2½ feet, then rapids with several falls of one-half to 1 foot each. The bed of the river is 500 feet wide and the water flows through little and crooked channels, and they are obstructed by loose rocks. The fall from beginning to end is 4½ feet approximately.

Between Hidalgo Falls and Gates Ferry, 195¼ miles below Waco, are fifteen slight sand and gravel shoals with snags lodged on many of them. There is also a wagon bridge of three spans, one of 100 feet and two of 75 feet each, the lower chords being 30 feet above bed of river.

At Gates Ferry rock on both banks extend out into river with a narrow channel between.

Between Gates Ferry and Cochrans Shoal the only obstructions are slight gravel shoals and snags in many places.

The Houston and Texas Central Railroad Bridge (Austin branch) is a wood and iron structure of three spans on rock piers; spans are 150 feet each; elevation 30 feet above the bed of river. The river is obstructed by old piling under the bridge; also by snags and drift lodged on a sand bar in the bed of the river.

Cochrans Shoals, 226¾ miles below Waco, is a rock and gravel shoal for 700 feet with a fall of 3½ feet from beginning to end, and has three small islands of rock in river with very narrow channels, obstructed by loose rocks.

Between Cochrans Shoal and San Felipe are eight gravel shoals and one small rock shoal, a narrow ledge across bed at water's surface.

About 5 miles below Cochrans Shoal is a large gravel bar in a bend of the river, forming a narrow channel next to the right bank, which is obstructed by trees falling into the river. Three-fourths of a mile below San Felipe is a rock shoal for one-fourth mile with rocks just to the water's surface.

Three and a half miles below San Felipe a rock shoal extends for three-fourths of a mile, with one fall of 1 foot and one of 1½ feet. The Texas Western Railroad crosses here. The bridge is one span of 150 feet and approaches; elevation 30 feet above bed of river.

One and a half miles below this is the Missouri, Kansas, and Texas Railroad Bridge of two spans of 150 feet each and one of 75 feet; elevation 30 feet above river bed. The river is here obstructed by old piling and a sand bar under the bridge. A gravel shoal just above this bridge.

Between the Missouri, Kansas and Texas and the San Antonio and Aransas Pass Railroad Bridge the only obstructions are small sand bars and gravel bars, with snags and drift lodged on them.

The San Antonio and Aransas Pass Railroad Bridge near Wallis is an iron structure of two spans of 112 feet each and approaches; elevation 40 feet above bed of river. Old piling in the river under the bridge.

At 1, 3½, 5½, 7, and 7½ miles below the San Antonio and Aransas Pass Railroad Bridge are gravel shoals and snags.

At 10, 11½, 12½, 13, 13½, 15, and 17 miles below the San Antonio and Aransas Pass Railroad Bridge are rock shoals and rapids from 300 feet to 500 yards long each, and with falls from one-half to 1½ feet each.

Ferris Shoals and Falls, about 4 miles above Richmond, is one-half a mile long, with 1½ feet fall in the first 200 feet; then rapids over the rock, and ending with an abrupt fall of 1½ feet. The rock extends along right bank for one-fourth of a mile below. The depth of water over the shoals was only from 2 to 8 inches.

The river, judging from water marks along the banks, has from 2½ to 3 feet more water at ordinary low water and 12 to 15 feet more at ordinary high water than at the present low stage, due to the long drought of six or eight months.

There was no water in the tributaries and no current in the reaches of the river where water was found covering the bed of the river. These reaches are from 1 to 5 miles long with a depth of from 1 to 7 feet of water in them.

METHOD OF IMPROVEMENT.

From only a preliminary examination the length of shoals and the height of falls were only approximately obtained, and it is very difficult to form any estimate as to the cost of improving the river; also from the fact that the river during rises is continually changing its bed alternately by washing away of one bank and depositing large quantities of sand and soil on the other bank, especially in the bends of the river.

All the wagon and railroad bridges will require draws put in them to allow steamboats to pass during ordinary high water.

A great many of the snags will be cut out and carried away by the first big rise, as they are only lodged on sand bars.

The difference in elevation of ordinary low water between Richmond and Waco is 313 feet.

* * * * * * *

I could not obtain any commercial statistics. The Commercial Club of Waco is having them compiled and will forward them to you.

Very respectfully, your obedient servant,

S. W. CAMPBELL, *Assistant Engineer.*

Maj. A. M. MILLER,
Corps of Engineers, U. S. A.

Agricultural products raised in the twelve counties bordering on the Brazos River, Texas, from Waco to Richmond.

Commodity.	Quantity.	Value.
Cotton.....bales..	281,234	$8,437,020
Cotton-seed products.....	.....	885,288
Grain.....bushels..	7,113,105	3,632,456
Wool.....pounds..	37,311	373,110
Sugar cane and products.....	.....	332,000
Cattle and hogs.....	.....	1,197,247
Farm products.....	.....	675,900
Total value.....	.....	15,533,021