

EXAMINATION AND SURVEY OF KISSIMMEE RIVER,  
FLORIDA, ETC.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORTS OF  
EXAMINATION AND SURVEY OF KISSIMMEE RIVER, FLORIDA,  
AND CERTAIN CONNECTING LAKES, ETC.

JANUARY 6, 1902.—Referred to the Committee on Rivers and Harbors and ordered to  
be printed.

WAR DEPARTMENT,  
*Washington, January 2, 1902.*

SIR: I have the honor to transmit herewith a letter from the Chief  
of Engineers, United States Army, dated December 28, 1901, together  
with copies of reports from Capt. Henry Jervay and Herbert Deakne,  
Corps of Engineers, dated August 23, 1899, and December 14, 1901,  
respectively, of a preliminary examination and survey made by the  
said officers in compliance with the provisions of the river and harbor  
act of March 3, 1899, of Kissimmee River, Florida, and connecting  
lakes and canals flowing into Lake Okechobee, thence down the Caloo-  
sahatchee River to the Gulf of Mexico.

Very respectfully,

ELIHU ROOT,  
*Secretary of War.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE OF THE CHIEF OF ENGINEERS,  
UNITED STATES ARMY,  
*Washington, December 28, 1901.*

SIR: The river and harbor act approved March 3, 1899, makes pro-  
vision for an examination and survey to be made of

Kissimmee River [Florida] and connecting lakes and canals flowing into Lake  
Okechobee, thence down the Caloosahatchee River to the Gulf of Mexico, with a  
view to improving the navigation of the channels therein

and I have the honor to submit the accompanying copy of report, dated August 23, 1899, by Capt. Henry Jervey, Corps of Engineers, on preliminary examination, and copy of report, dated December 14, 1901, with maps, by Capt. Herbert Deakyné, Corps of Engineers, on survey of the locality.

It appearing from Captain Jervey's report on preliminary examination that improvements already made by the General Government have resulted in securing in the Caloosahatchee River from Fort Thompson to the Gulf of Mexico a depth of water sufficient for the present needs of commerce, that the waterway between Fort Bassinger (on the Kissimmee River 37.5 miles above its entrance into Lake Okechobee) and Fort Thompson is not now used for carrying trade, and that there is at present no demand for such trade between the points last mentioned, only that portion of the route which is located between the town of Kissimmee (situated at the headwaters of the Kissimmee River) and Fort Bassinger was reported as being worthy of improvement by the United States. Accordingly the local officer was directed, by authority of the Secretary of War, to make a survey of the section thus reported as worthy of improvement, and to extend said survey to the mouth of the Kissimmee River, in order that necessary data might be obtained concerning the characteristics of the entire river. Istokpoga Creek, 9.4 miles long, connecting the lake of the same name with the Kissimmee River 10.5 miles north of Bassinger, was also included in the survey.

The plan of improvement presented contemplates securing in the Kissimmee River (including the connecting canals and lakes), between Kissimmee and Fort Bassinger, and also in Istokpoga Creek, a channel width of 30 feet and depth of 3 feet at the ordinary stage of the river. To effect this object it is estimated that a certain amount of dredging work and bulkhead construction and the removal of snags and trimming of trees will be necessary, the total cost of which is estimated at \$24,220.90.

Very respectfully, your obedient servant,

G. L. GILLESPIE,  
Brig. Gen., Chief of Engineers,  
U. S. Army.

Hon. ELIHU ROOT,  
Secretary of War.

PRELIMINARY EXAMINATION OF KISSIMMEE RIVER, FLORIDA, AND CONNECTING LAKES AND CANALS FLOWING INTO LAKE OKECHOBEE, THENCE DOWN THE CALOOSAHATCHEE RIVER TO THE GULF OF MEXICO.

UNITED STATES ENGINEER OFFICE,  
Tampa, Fla., August 23, 1899.

GENERAL: I have the honor to present the following report upon the preliminary examination of Kissimmee River and connecting lakes and canals flowing into Lake Okechobee, thence down the Caloosahatchee River to the Gulf of Mexico, with a view to improving the navigation of the channels therein, as directed by the river and harbor act approved March 3, 1899.

The examination was made by Mr. W. H. Caldwell, assistant engineer, whose report is appended.

This is the first examination that has been made of this route above the headwaters of the Caloosahatchee, and as it flows through an extensive region not reached by regular means of transportation the examination has required considerable time and expense. The assistant engineer secured a steamer suitable to make the entire trip by water, and fortuitous rains furnished a navigable depth unusual at this season.

The water route examined is about 309 miles in length, extending south from the town of Kissimmee, Fla., through a succession of shallow lakes and canals for about 46 miles to the foot of Lake Kissimmee, thence through the Kissimmee River proper for about 145 miles to Lake Okechobee, through the latter lake to a canal leaving its southwest corner, thence through several canals and small lakes to the upper waters of the Caloosahatchee River, which continues the route to San Carlos Bay in the Gulf of Mexico.

The portions of the route at present used for navigation are from Kissimmee to Fort Bassinger on the Kissimmee River, about 40 miles above its entrance into Lake Okechobee, and from Fort Thompson, on the Upper Caloosahatchee, about 23 miles west of Lake Okechobee, to the Gulf of Mexico. The intermediate portion from Fort Bassinger to Fort Thompson is seldom navigated except by tourist parties, and during a large part of the year boats could not get through. The navigation on the upper stretch of the route enables the town of Kissimmee to serve as a supply depot for the extensive cattle interests between that point and Fort Bassinger. The freight carried downstream consists of grain, forage, lumber, and general supplies for the population along the river, all of whom are far distant from railroads. The upriver freight consists of oranges, hides, and vegetables. The cattle and hogs are not transported by river, but are driven across country to some seaport, usually Puntarasa, at the mouth of the Caloosahatchee River, where they are shipped to market.

The navigation of the Caloosahatchee River, which has already been improved by the National Government below Fort Thompson, affords an outlet for the immense crop of pineapples, oranges, lemons, and other citrus fruit raised along this river. This produce is mostly taken by steamer to Myers, thence to Punta Gorda, from which point it is shipped by rail. Great numbers of cattle and hogs are also raised in this section.

As before stated, the stretch between Fort Bassinger and Fort Thompson is not now used for carrying trade, nor is there any demand at this time for such trade, as the country is an uninhabited swamp. There are no settlements on the shores of Lake Okechobee except a few orange farms on Taylors Creek, which empties into the northern extremity of the lake. Nor does it seem probable that a through water route from Kissimmee to Puntarasa, at the mouth of the Caloosahatchee, would benefit anyone in particular nor change the present conditions. Kissimmee Valley would continue to draw supplies from the town of Kissimmee, and Caloosahatchee points would continue to trade with Myers, and through that town with regular markets. We may, therefore, eliminate from consideration in any present scheme for improvement—

1. The waterway from Fort Bassinger to Fort Thompson.

2. The Caloosahatchee River from Fort Thompson to the Gulf of Mexico, as the improvements already made have resulted in a depth sufficient for the present needs of commerce.

Our study will then be confined to the lakes, canals, and river above Fort Bassinger.

The territory tributary to this water route comprises about 2,500 square miles. It is essentially a cattle country, the mild climate, abundant pasturage, and almost unlimited ranges reducing the cost of raising to a low figure. Orange culture has reached considerable proportions also, and is on the increase. The railroads that parallel this valley on the east and west are from 30 to 50 miles distant and the cross-country roads are few and swampy, sometimes impassable. They are used only by mail riders, as all supplies are drawn from Kissimmee, being carried on wagons when low water stops navigation.

The chief obstacle to the development of this region is the frequent occurrence of long periods of extremely low water covering sometimes nearly the half the year, during which navigation is impossible and the population cut off from their usual source of supply.

The periods during which navigation has been stopped in the Kissimmee River on account of low stages of water are reported as follows:

1895 .....	five months.
1896 .....	none.
1897 .....	eight months.
1898 .....	five months.
1899 .....	probably none.

The obstructions to navigation are chiefly sand bars. There are some snags and many obstructive bends in the river, which is very tortuous. Water hyacinth is not present to any great extent. Local attempts at improvement of the waterway have been made by dredging canals connecting the lakes near Kissimmee and by making "cut-offs" across some of the worst bends in the river. It is said that the canals have lowered the level of the lakes, but have on the whole been a benefit to navigation, providing straighter and safer channels. The cut-offs have likewise proved beneficial, and injury to the river has not been observed. The work done has been on a very small scale. The depths in the several channels at the time of this examination are given in the table appended to this report. They are seen to vary from 1.8 to 30 feet, being generally from 3 to 5 feet.

Parties interested in navigation state that a channel 36 inches deep at low water and 30 feet wide will be ample for the present commerce.

The commercial statistics gathered from several points along the entire route are given in Mr. Caldwell's report.

A summary indicates the following tonnage and value of water-borne commerce in the Kissimmee Valley:

Shipping point.	Kind of freight.	Tons.	Value.
Kissimmee .....	Forage and general supplies .....	1,218.6	\$151,346.00
Bassinger .....	Produce and hides .....	171.3	37,695.00
Total .....		1,389.9	189,041.00

The cattle and hogs statistics in the same valley are:

	Head.	Tons.	Value.
Cattle .....	15,000	2,250	\$180,000.00
Hogs .....	1,000	30	5,000.00

Incidentally, the shipments of the latter from Puntarasa should be noted as follows:

	Head.	Tons.	Value.
Cattle .....	21,000	3,150	\$252,000.00
Hogs .....	4,000	120	20,000.00

An improvement of the extent desired to the channels above Fort Bassinger would be a direct benefit to the cattle raisers and orange growers on the banks, and primarily to individual interests, but indirectly the general commerce of the State and the country at large would be benefited by the development of this region from which Cuba and the West Indies are even now drawing large supplies of cattle.

In view of the present commerce and the probable great benefit to commerce to be derived from improvements of small extent I am of the opinion that the waterway from Kissimmee, Fla., to Fort Bassinger, Fla., is worthy of improvement by the General Government. I have to recommend that the necessary survey be extended to the mouth of the Kissimmee River, as a study should be made of the stream in its entirety before improvements are undertaken. Such a survey would also practically complete the data for the whole route from Kissimmee to the Gulf of Mexico as the survey of the Caloosahatchee River has already been made (see Captain Black's report, Report Chief of Engineers for 1888, Part II, p. 1095).

A survey as recommended would cost about \$4,000. It could not be made until after the high-water period, probably not before January.

An approximate map<sup>a</sup> covering the region under consideration accompanies this report. It was kindly furnished by the associated railway land department of Florida.

Very respectfully, your obedient servant,

HENRY JERVEY,  
*Captain, Corps of Engineers.*

Brig. Gen. JOHN M. WILSON,  
*Chief of Engineers, U. S. A.*

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,  
U. S. ARMY,  
*August 30, 1899.*

Respectfully submitted to the Secretary of War.

In accordance with the provisions of the river and harbor act of March 3, 1899, a preliminary examination has been made of the Kissimmee River and connecting lakes and canals flowing into Lake Okechobee, Florida, thence down the Caloosahatchee River to the Gulf of Mexico, with a view to improving the navigation of the channels therein, and the within report of the results of this examination is submitted for action of the Secretary of War.

It is reported that improvements already made have resulted in securing in the Caloosahatchee River from Fort Thompson to the Gulf of Mexico a depth of water sufficient for the present needs of com-

<sup>a</sup> Not printed.

merce, and that the waterway from Kissimmee to Fort Bassinger is worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated, as proposed by Captain Jervey.

JOHN M. WILSON,  
Brig. Gen., Chief of Engineers,  
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,  
September 12, 1899.

Approved as recommended by the Chief of Engineers.  
By order of the Secretary of War:

A. N. THOMPSON,  
Acting Chief Clerk.

APPENDIX 1.

*Kissimmee River and connecting lakes and canals, through Lake Okechobee to the Gulf of Mexico.*

[Condition of waterway in August, 1899.]

Locality.	Length of channel.	Width of canals, etc.	Soundings, Aug. 1-9, 1899 (in feet).	Nature of bottom and channels.
	<i>Miles.</i>	<i>Fect.</i>		
Lake Tohopekaliga.....	11.50		2 to 17	Sand and mud; sand bars.
Southport Canal.....	4	70	1.8 to 4	Many shoal places.
Cypress Lake.....	2.50		3.5 to 11	Sand and mud.
Seventy-foot Canal.....	2.25	70	3.3 to 6.7	Sandy.
Lake Hatcheechee.....	2.25		6 to 10	
Hatcheechee Canal.....	.75	36	3 to 5	
Kissimmee River.....	*2.75	36	3 to 7	Dangerous snag.
Fort Gardner Canal.....	1.50	36	2.8 to 6	
Lake Kissimmee.....	18.25		2.5 to 12	Sandy; no obstructions.
Kissimmee River.....	145	<sup>b</sup> 100		
Ute to Long Hammock.....			4 to 10	Shoals and bends.
Long Hammock to Orange Hammock.....			2.5 to 12	
Orange Hammock to Bassinger.....			3 to 9	Snags and bends.
Bassinger to Wolf Island.....			3.5 to 10	Sand bars; abrupt bends.
Wolf Island to river's mouth.....			4 to 30	One cut-off.
Lake Okechobee.....	31		5 to 11	Hard sand and mud; no obstructions.
Okechobee Canal.....	3		2 to 6.6	Sand underlaid with clay; very shallow in places.
Lake Hikochee.....	4		2 to 5	Soft mud; shallow.
Canal and river.....	9.75		3 to 7	
Bonnet Lake.....	.50		1.5 to 5	
Canal.....	1		1.4 to 4	Two sand bars.
Lake Flirt.....	2		1.8 to 5	Sand and mud; shallow.
Caloosahatchee River:				
Lake Flirt to Fort Thompson.....	4		2.5 to 6	Sand and rock; channel narrow and shallow.
Fort Thompson to Alva.....			5 to 20	
Alva to Myers.....	43.50		5.5 to 31	Sand; good water; some snags.
Myers to Puntarasa.....	17		6 to 22	Broad and good channel, but tortuous, due to oyster bars.
San Carlos Bay.....	2.50		8 to 25	Sand.

\* Cut-off.

<sup>b</sup> At entrance.

• These depths were taken from the United States Coast Survey chart No. 473.

## APPENDIX 2.

REPORT OF MR. W. H. CALDWELL, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,  
Tampa, Fla., August 15, 1899.

CAPTAIN: I have the honor to submit the following report on a preliminary examination of—

“Kissimmee River and connecting lakes and canals flowing into Lake Okechobee, thence down the Caloosahatchee River to the Gulf of Mexico, with a view to improving the navigation of the channels therein.”

Acting under your instructions, the examination made was a thorough one. Mr. William P. Jervey, overseer, accompanied me to assist in collecting data and making soundings. We traversed the waterway in both directions, which afforded us exceptional opportunity for observations and the collection of data. This report is arranged in divisions, in order that you may more easily refer to the subjects embraced herein.

## DIVISION 1. ITINERARY.

We left Tampa at 7.35 p. m. July 31, 1899, and arrived at Kissimmee, Osceola County, Fla., at 10.40 the same evening. The following morning, Tuesday, August 1, at 8 o'clock, we sailed from Kissimmee on the chartered stern-wheel steambot *Roseada*, whose master (and owner) is Capt. Clay Johnson. Tuesday night, at 7.30 o'clock, the steamer was moored at Long Hammock Landing, Kissimmee River. On Wednesday morning, August 2, the steambot was gotten under way at dawn and at dusk was moored at Fort Bassinger, Kissimmee River. At 7 o'clock on Thursday morning, August 3, the steambot proceeded down the river channel, and at 8 o'clock that evening was brought to anchor in Lake Okechobee, 1 mile northward of the entrance to the upper canal, which connects Okechobee and Lake Hikpochee. The journey was continued at daybreak on Friday, August 4, and we reached Fort Myers that afternoon. Our arrival was communicated to you. Saturday was spent collecting commercial statistics of Myers and Puntarasa and obtaining information about the channels leading to the Gulf of Mexico. Early on Sunday morning, August 6, we started on the return trip. That night the steambot was anchored at the head of the canal leading from Lake Hikpochee into the Caloosahatchee River. Monday night the vessel was moored at Mrs. J. M. Pierce's Landing, Kissimmee River, and on Tuesday night at Bluff Hammock Landing, in the same river. On Wednesday evening, August 9, at 6.15 o'clock, we reached the steambot dock at Kissimmee. There we took the train, and arrived in Tampa at 11.30 p. m., having been absent nine days.

## DIVISION 2. GENERAL DESCRIPTION.

The flourishing town of Kissimmee is the county seat of Osceola, and is situated on the northwestern extremity of Tohopekaliga Lake. It has a population of 1,000 or more. It being the supply depot for a fruit and vegetable section, as well as for immense cattle ranges, its commercial transactions are very large. The Plant Railway System passes through the town. Two lines of steamers make weekly trips throughout the year (when the stage of water will permit) from Kissimmee to Fort Bassinger, a distance of about 150 miles, and it is reported that a third steamer is now building which will engage in the same traffic. During the winter season small steamers occasionally make the round trip from Kissimmee to Fort Myers with parties of tourists.

The waterway from Kissimmee to the Gulf of Mexico is 309 miles long. Two and one-half miles of the route is through a bay—San Carlos; 75 miles in lakes, viz, Tohopekaliga Lake, Cypress Lake, Hatcheneha Lake, Lake Kissimmee, Lake Okechobee, Lake Hikpochee, Bonnet Lake, and Lake Flirt; 213 miles in rivers, to wit, Kissimmee River and Caloosahatchee River; and 18½ miles in canals, namely, Southport Canal, Seventy-foot Canal, Hatcheneha Canal, Fort Gardner Canal, Okechobee Canal, and Twelve-mile Canal. The country that is tributary to this waterway covers an area of about 2,500 square miles. Though sparsely settled, its inhabitants are entirely dependent upon the water route for transportation. After leaving the town of Kissimmee not a single point in the area mentioned is on or near a railroad. There are twenty-five landings for steamboats between Kissimmee and Lake Okechobee. Twelve or 13 miles from Turkey Hammock Landing—on the eastern side of Lake Kissimmee—there is an inland community called Lakeview settlement. It has two stores and a post-office, the latter being officially known as Whittier. At

the southwestern extremity of Lake Kissimmee is Rattlesnake Hammock Landing, where there is a warehouse and post-office, the latter being officially known as Ute. Alligator Bluff Landing is on the Kissimmee River, and a few miles westward of it is a post-office called Alger. At Fort Bassinger are three stores and a post-office, the official designation of the latter being Bassinger. Fort Drum, 14 miles northeastward from Bassinger, has a post-office and two stores.

There are no landings or settlements on Lake Okechobee. Along Taylors Creek, which empties into the northeastern corner of the lake, are several orange groves. A number are being set out this month, and clearings are under way for more.

The thriving and beautiful village of Fort Myers is the most important settlement on the Caloosahatchee River. A large mercantile business is conducted there, the country around being a prosperous fruit and vegetable section. The post-office is officially designated Myers. The mails are daily, across country by ferry and back to Punta Gorda, which is a railroad terminus. During the tourist season, namely, from January to May, there are daily steamers between Fort Myers and Punta Gorda. During the remainder of the year the steamer service is three times per week. These steamers carry the mails also. There is an independent line steamer which runs occasionally between Fort Myers and Punta Gorda. Two schooners make semimonthly trips to Tampa. A line of steamers makes trips three times a week to upriver points as far as Fort Thompson, a distance of 43½ miles.

Puntarasa is at the mouth of the Caloosahatchee River, and is 17 miles below Fort Myers. There is a post-office, telegraph and express office there. The steamers plying between Fort Myers and Punta Gorda touch at Puntarasa regularly. Immense quantities of vegetables and fruits are shipped from there. Large numbers of cattle and swine are exported to Cuba from Lee, De Soto, and Osceola counties at this point. Vessels drawing 9 feet can make the anchorage.

There are seven post-offices on the Caloosahatchee River above Fort Myers. Taken in succession—going upstream—they are as follows: Olga, Rialto, Caloosa, Alva, Denand, Labelle, and Fort Thompson. The last place is 23 miles from Lake Okechobee and 43½ miles above Fort Myers. There are two stores at Alva, and a sawmill near by. There is a store and large sawmill at Denand. There is a store at Labelle. Buckingham post-office is about 9 miles across country from Fort Myers. It is on the left bank of Orange River, or Twelve-mile Creek, which empties into the Caloosahatchee above Beautiful Island. Besides the post-office landings, the steamers touch at various points and farms to discharge or receive freight.

### DIVISION 3. TOPOGRAPHY.

Lake Okechobee may be considered the central division of this waterway, with the Kissimmee River route (to the northward) on one hand and the Caloosahatchee River route (to the westward) on the other. The extremities of the former route are Kissimmee town and the mouth of the Kissimmee River, on the northern side of Lake Okechobee. The extremities of the latter route are Sanibel Island, at the Gulf entrance, and the head of Okechobee Canal, on the western side of Lake Okechobee. The head of navigation on the Caloosahatchee is Fort Thompson; the lower point of navigation on the Kissimmee is Fort Bassinger. The approximate geographical positions of these points, taken in regular order from north to south, are:

Kissimmee town, latitude 28° 18' N., longitude 81° 23' W.  
 Fort Bassinger, latitude 27° 22' N., longitude 81° 02' W.  
 Mouth of Kissimmee River, latitude 27° 09' N., longitude 80° 55' W.  
 Mouth of Okechobee Canal, latitude 26° 47' N., longitude 81° 03' W.  
 Fort Thompson, latitude 26° 44' N., longitude 81° 24' W., and  
 Sanibel Island light-house, latitude 26° 27' N., longitude 82° W.

Kissimmee Valley is a nearly level country. It extends about 75 miles in a general north-and-south direction, and has an east-and-west width varying from 10 to 50 miles. The lake region forming the headwaters of Kissimmee River is due west, and only 30 miles distant, from the lakes at the source of St. Johns River—the two rivers flowing in directly opposite directions. Many square miles of the Kissimmee Valley is covered with splendid grass, and the whole country being well-watered, this section has no superior as a cattle range. Slight elevations throughout the valley are densely wooded. Some of them have been cleared and form excellent ground for vegetable farming and orange raising. The borders of the lakes and rivers are generally marshy, along which grow bogrush, bonnets, flags, lovers' vine, ferns, and wild grasses. On the hammocks and along either edge of the valley were seen palmetto, live oak, white oak, pine, and gum trees. Myrtle, maple, sumac, red bay, white bay, cypress, cabbage palms, and willows cover the banks of both river and



lake at many places. We watched closely for water hyacinths, but saw none until 5 or 6 miles below Fort Bassinger, in the Kissimmee River. There a small bayou is covered with it, and a few patches were observed along the river's banks for the next several miles. The last 20 miles of the river, from Wolf Island to Lake Okechobee, is bordered by an impenetrable marsh, which extends back from the river for many miles on either side. Thick patches of willow and myrtle are frequent. The vegetation is wild and rank, consisting of grass, water lettuce, smartweeds, wild cotton, bonnets, and flags.

Lake Okechobee's borders are similar to the lower end of Kissimmee River.

The canal from Okechobee into Lake Hikpochee is bordered by a rank growth of willows, water oak, myrtle, grass, wild cotton, and water lettuce. Hikpochee, Bonnet Lake, and Lake Flirt, are surrounded by marshes. Being shallow, the growth of bograss, cat-tails, bonnets, and flags covers a large portion of their bottoms, and water lettuce and lovers' vines run over many acres of their surface. On either side of the canal leading from western extremity of Lake Hikpochee as well as the canal between Bonnet Lake and Lake Flirt are vast areas of wild millet. Great patches of willows occur here and there, as well as an occasional palmetto hammock. A beautiful grassy prairie commences below Lake Flirt and extends to the wooded region at Fort Thompson. From there to the mouth of the Caloosahatchee River is a finely wooded country. Palmettoes, pines, and oaks predominate. The river's banks are high, as compared with the Kissimmee. Although overflows occur, they subside quickly—largely due to improvements made in the river channel by the United States Government. The Caloosahatchee Valley is about 40 miles long and 20 miles broad. Its soil is rich and productive. Vegetables and all kinds of citrus fruits are largely grown there. Particular watch was kept for the water hyacinth along this route. The first seen was at Alva—42½ miles below Lake Okechobee. From Alva to the mouth of the Caloosahatchee are great patches of water hyacinth and water lettuce.

#### DIVISION 4. HYDROGRAPHY.

Tohopekaliga Lake, covering an area of about 24,000 acres, is the source of the Kissimmee River. The bottom of the lake is sand and mud. Paradise Island is in the western portion of the lake, while a little farther west and south is Summerlin Island. A sand bar runs across the lake above Paradise Island with a depth over it varying from 1 to 6 feet, dependent upon the stage of water. From the southeastern extremity of the island a sand bar runs into the lake, and there is also one running out from the eastern shore. It is easy to avoid these sand bars if one knows the channels. There are no snags or other like obstructions in the lake. The steamboat route across Tohopekaliga to the Southport Canal is 11½ miles. At the entrance to the canal is a sand bar with only about 2½ feet of water over it. This canal is 105 feet wide and 4 miles long. Only 70 feet of its width was ever dredged to a depth navigable at the ordinary stage of water. The Kissimmee River starts from Tohopekaliga Lake at a point eastward of the canal, and flows into Cypress Lake also eastward of the canal's exit. A portion of the canal is through the old river bed. Nearly all the water from the lake now runs southward through the canal. There are many shoal places in the canal and its lower end is particularly difficult to navigate. The bottom is hard sand.

Cypress Lake is the next link in this chain of waterways. It covers an area of about 6,000 acres, and has a sandy and mud bottom. It is 2½ miles across the lake to the entrance of Seventy-foot Canal. This canal joins Cypress Lake and Hatcheneha Lake. The course of the Kissimmee River between these lakes is westward of the canal. The stream is very crooked and full of snags, but has been navigated by small steamers. The canal is now used for traffic exclusively. It is 70 feet wide, 2½ miles long, and has a sandy bottom.

Lake Hatcheneha, covering an area of about 10,000 acres, offers no obstruction to navigation. This lake is connected with Lake Kissimmee partly by river and partly by canal. That portion of the Kissimmee River between these lakes, though containing many sharp bends, is wide and navigable. It is 2½ miles across Lake Hatcheneha to the entrance of Hatcheneha Canal. This canal is 36 feet wide and three-fourths mile long. The lower end of this canal joins the river, the river's course from Hatcheneha Lake to that point being west of the canal. From the southern extremity of Hatcheneha Canal is a stretch of 2½ miles in the river to a point where the Fort Gardner Canal starts. In that portion of the river between the two canals is a cut-off which is 36 feet wide. There is a snag in this portion of the river which is a danger to navigation. Fort Gardner Canal is 36 feet wide and 1½ miles long. It is shallow and its southern entrance is obstructed. The Kissimmee River flows eastward of this canal. The sketch\* at the bottom of this page shows roughly the

\*Not printed.

approximate position of the two canals and the cut-off, as well as the river's course between Hatcheneha Lake and Lake Kissimmee.

Lake Kissimmee, the last one until Okechobee is reached, covers an area of 36,000 acres. Its bottom is sandy and its waters offer no obstruction to navigation. From the canal exit across the lake to the entrance of Kissimmee River is 18½ miles. On this lake are steambot landings known as Jack Hammock, Shivers Landing, Stokes Landing, Grape Hammock, and Turkey Hammock. On the river between this lake and Hatcheneha Lake are three landings, namely, Shell Hammock, East Gardner, and West Gardner (or Fort Gardner). Southport, a landing on Tohopekaliga Lake, is at the head of the Southport Canal.

Kissimmee River, connecting Lake Kissimmee and Lake Okechobee, is about 145 miles long. It is a sluggish and very sinuous stream. It presents the anomaly of being much wider at its headwaters than at its mouth, though it becomes deeper at its lower end. Entering the river from Lake Kissimmee its width is 100 feet, or more, and its depth varies from 8 to 12 feet. A shoal with about 3 feet over it was found in the river about 2½ miles from Lake Kissimmee. In the first 25 miles of the river's length are twelve cut-offs. About one-fourth mile of the river's channel is very shallow just above Long Hammock. Rattlesnake Hammock, where there is a post-office called Ute, is on the river's right bank just after leaving Lake Kissimmee; and 4 miles farther down is Long Hammock Landing. The next landing is Bay Hammock; then Cabbage Bluff, or Jack Whidden's; Alligator Bluff comes next, and then Orange Hammock, which is 25 miles from Ute. On the right bank of the river, 9 miles farther down, is Fort Kissimmee, just above which landing the river is wide and shallow. Then follow landings at McLaughlins, Prairie Camp, Bluff Hammock, and Mico Bluff. There are two snags in this stretch of the river. Mico Bluff is 45 miles below Orange Hammock. In the vicinity of McLaughlins Landing the river presents a remarkable example of sinuosity. Four sketches\* of the river's course there are given here for your consideration.

The first sketch is 1 mile above Long Hammock. The river's course from *a* to *b* is about 2½ miles, and the slope is very small. The distance from *a* to *b* in a straight line is 60 or 70 feet.

The second sketch represents a point on the river one-half mile above Long Hammock. The distance from *a* to *b* in the river channel is nearly 1 mile and the bend at *c* is very sharp. As is evident from the sketch, a vessel bound either up or down the river has to change her course nearly sixteen points (180°) at *c*, and it requires a most skillful pilot under such circumstances. Fortunately the river is wider at *c* (as it is at nearly every bend) and affords a vessel additional room for turning.

The third sketch presents the peculiarity of two portions of the river flowing parallel, and in directly opposite directions, for a considerable distance. From *a* to *b* in a straight line is less than 25 feet. This bend is about 1½ miles below McLaughlins Hammock.

The fourth sketch shows an almost circular loop in the river's course. It is about 3½ miles below Long Hammock, the name sometimes given McLaughlins Landing. The distance from *a* to *b* in a straight line is about 50 feet.

Sketches were made of forty or fifty of the eccentric bends in the river, but on account of the space required for them only one more will be embodied in this report. At the point in question (*c*) the river presents the unique feature of a loop within a loop. This portion of the river is navigable and has a very good depth of water, but the steamers use a cut-off—shown by dotted lines from *a* to *b*. The cut-off is not as straight as the sketch would indicate; still it saves over the regular river route 4 miles in distance. The shorter route is known as Jack Scarborough, or Bumblebee, Cut-off.

Another important cut-off is called "Turtle Mound." Its course is crooked, but is shorter than the regular river. Its upper entrance is abrupt, and is called "Hole-in-the-wall."

The first landing below Mico Bluff is Rob Pierce's, 13 miles down the river. Three miles farther is Laniers Landing; and Bassinger Post-office, commonly called Fort Bassinger, is 9 miles farther. One-half mile below Bassinger Post-office is Mrs. J. M. Pierce's Landing; and 3¼ miles farther down the river is old Fort Bassinger. There are sand bars in the river between the two latter landings. In the vicinity of Laniers Landing and Bassinger Landing the river channel is extremely crooked, having many abrupt turns in its course.

Istokpoga Creek, which drains Lake Istokpoga and a large number of adjacent lakes, empties into the Kissimmee River from the westward about 20 miles above Bassinger Post-office. The creek is about 10 miles long, and has many snags in it.

An island in Kissimmee River, called Wolf Island, is 26 miles below Bassinger Post-office. In that stretch of the river are two snags and four shoal places. There is one cut-off, which is called Reynolds. Between Wolf Island and Lake Okechobee—a distance of 24 miles—there are no settlements or landings. The river is somewhat narrower than farther upstream, but is very deep.

Lake Okechobee, covering an area of 1,080,000 acres, affords a sufficient depth of water with no obstructions for navigation. There are four large islands in its southern portion. The bottom of the lake is hard sand and mud.

Okechobee Canal, leading from Lake Okechobee into Lake Hikpochee, is 28 feet wide and 3 miles long. The bottom is sand, underlaid with hard clay. The canal is shallow in several places, particularly at its lower end.

Lake Hikpochee, covering an area of 9,000 acres, is shallow. Its bottom is soft mud. From Lake Hikpochee to Bonnet Lake is a succession of canals and bayou or river channels. The length of the canals aggregates 6 miles, and of the river 3½ miles. It is 4 miles across Lake Hikpochee and one-half mile across Bonnet Lake.

Bonnet Lake, covering an area of about 500 acres, is shallow, and has a mud bottom. A canal 1 mile long and about 30 feet wide connects Bonnet Lake and Lake Flirt. A sand bar has formed across it in two places.

Lake Flirt, covering an area of 1,000 acres, is shallow. Its bottom is mud and sand. The channel through it is 2 miles long. The river channel from Lake Flirt to Fort Thompson is 4 miles long. The banks are low, and the channel narrow and shallow. The bottom is sand and rock.

From Fort Thompson to Myers, a distance of 43½ miles, the river's banks are generally high. The bottom is sand, and there is sufficient water for all-the-year navigation. The navigation is obstructed to a certain extent by snags, for when the river overflows the banks cave in and carry the adjacent trees with them.

For a distance of 17 miles, from Myers to the mouth of the Caloosahatchee, the river is broad and has a good channel. Many oyster bars obstruct this portion of the river and cause the channel to be tortuous.

It is 3 miles across San Carlos Bay, from the mouth of the Caloosahatchee to the bar at the entrance leading to the Gulf of Mexico. The least depth in the bay channel is 8 feet. The bottom is sand.

DIVISION 5. SOUNDINGS.

We took frequent soundings throughout the route, and for the sake of brevity they are tabulated below. No soundings were obtained between Myers and the Gulf of Mexico, because the chartered steamer *Roseada*, having no condenser, could not run in salt water. The maximum and minimum depths for each section of the waterway are given.

*Maximum and minimum depths.*

[August 1-9, 1899.]

Locality.	Depths (in feet).
Tohopekaliga Lake.....	2 to 17
Southport Canal.....	1.8 to 4
Cypress Lake.....	3.5 to 11
Seventy-foot Canal.....	3.3 to 6.7
Hatcheneha Lake.....	6 to 10
Hatcheneha Canal.....	3 to 5
Kissimmee River.....	3 to 7
Fort Gardner Canal.....	2.8 to 6
Lake Kissimmee.....	2.5 to 12
Kissimmee River:	
From Ute to Long Hammock.....	4 to 10
From Long Hammock to Orange Hammock.....	2.5 to 12
From Orange Hammock to Bussinger.....	3 to 9
From Bassinger to Wolf Island.....	3.5 to 10
From Wolf Island to river's mouth.....	4 to 30
Lake Okechobee.....	5 to 11
Okechobee Canal.....	2 to 6.6
Lake Hikpochee.....	2 to 5
Canal and river.....	3 to 7
Bonnet Lake.....	1.5 to 5
Canal.....	1.4 to 4
Lake Flirt.....	1.8 to 5
Caloosahatchee River:	
From Lake Flirt to Fort Thompson.....	2.5 to 6
From Fort Thompson to Alva.....	5 to 20
From Alva to Myers.....	5.5 to 31
From Myers to Putnam.....	6 to 23
San Carlos Bay.....	8 to 25

\*These depths were taken from the United States Coast Survey chart No. 173.

## DIVISION 6. COMMERCIAL STATISTICS.

The commercial statistics, as furnished by the leading merchants and transportation companies, are separately tabulated for the principal business points. In the table for the town of Kissimmee particular care has been taken to exclude its commerce not transported by water. In the table for Bassinger is included the cattle shipment of the Kissimmee Valley; the cattle, though, are never shipped on the river as a consequence of low water, but are driven to some seaport. In the shipments from Puntarasa are included the Kissimmee cattle, in order to exhibit the freight business from that port. The tables show the approximate quantity of all items shipped or received by water during the year ending December 31, 1898.

Items.	Quantity.	Weight in tons.	Estimated value.
<i>Shipments from Kissimmee.</i>			
Merchandise (groceries, dry goods, furniture, and hardware).....		307.5	\$86,750
Fertilizers.....		22.5	800
Grain.....		370	25,000
Hay.....		17.6	350
Lumber:			
Rough.....feet.....	36,800	73.6	368
Dressed.....do.....	48,200	84.4	873
Shingles.....	92,000	16.1	230
<i>Receipts at Kissimmee.</i>			
Hides.....number.....	20,000	20	12,000
Oranges.....boxes.....	5,500	220	14,500
Grape fruit.....do.....	1,000	40	8,000
Vegetables.....crates.....	2,250	45	2,250
Honey and sirup.....		2	225
Total shipments and receipts.....		1,218.6	151,346
<i>Shipments from Bassinger.</i>			
Hides (alligator).....number.....	3,000	10.5	1,800
Honey, sirup, etc.....		1	100
Cattle.....number.....	15,000	2,250	180,000
Hogs.....do.....	1,000	30	5,000
<i>Receipts at Bassinger.</i>			
Merchandise (groceries, dry goods, furniture, hardware, hay, and grain).....		105	35,000
Lumber:			
Rough.....feet.....	10,000	20	100
Dressed.....do.....	15,000	28	240
Shingles.....	30,000	5.3	105
Orange trees.....	1,000	1.5	350
Total shipments and receipts.....		*171.3	*37,695

\*Neither the weights nor values of cattle and hogs are included in the aggregate figures, because it could not be learned what proportion belonged to Bassinger and how much to other points along the river. The total cattle and hog statistics are summarized in Puntarasa table, anyway.

Items.	Quantity.	Weight in tons.	Estimated value.
<i>Shipments from Labelle.</i>			
Cattle.....number.....	3,000	450	\$36,000
Hogs.....do.....	1,000	30	5,000
Hides:			
Alligator.....do.....	30,000	105	15,000
Deer.....do.....	335	.5	67
Furs:			
Otter.....do.....	250	.6	1,000
Coon.....do.....	3,000	.8	750
<i>Receipts at Labelle.</i>			
Merchandise (groceries, dry goods, hay, and grain).....		11	4,000
Lumber, rough.....feet.....	15,000	30	150
Shingles.....	6,000	1	25
Total shipments and receipts.....		*148.9	*20,992

\*Neither the weights nor values of the cattle and hogs are included in the aggregate figures. Both are shipped from Puntarasa, and are summarized in that table.

Items.	Quantity.	Weight in tons.	Estimated value.
<i>Shipments from Denand.</i>			
Cattle.....number..	2,000	300	\$24,000
Hogs.....do.....	1,000	30	5,000
Lumber.....feet..	500,000	1,250	7,000
Hides (alligator).....number..	2,000	6	1,000
Oranges.....boxes..	175	7	350
Sirup.....gallons..	200	1	100
<i>Receipts at Denand.</i>			
Merchandise (groceries, dry goods, furniture, hay, and grain).....		15	5,000
<b>Total shipments and receipts.....</b>		<b>*1,279</b>	<b>*13,450</b>

\* Neither the weights nor values of the cattle and hogs are included in the aggregate figures. Both are shipped from Puntarasa, and are summarized in that table.

Items.	Quantity.	Weight in tons.	Estimated value.
<i>Shipments from Alva.</i>			
Cattle.....number..	1,000	150	\$12,000
Hogs.....do.....	1,000	30	5,000
Hides (alligator).....do.....	10,000	30	6,000
Oranges.....boxes..	4,000	160	8,000
Vegetables.....crates..	5,000	150	5,000
<i>Receipts at Alva.</i>			
Merchandise (groceries, dry goods, hay, grain, fertilizers, crate material, etc.).....		91	30,000
<b>Total shipments and receipts.....</b>		<b>*431</b>	<b>*49,000</b>

\* Neither the weights nor values of the cattle and hogs are included in the aggregate figures. Both are shipped from Puntarasa, and are summarized in that table.

Items.	Quantity.	Weight in tons.	Estimated value.
<i>Shipments from Myers.</i>			
Oranges.....boxes..	13,000	585	\$29,250
Grape fruit.....do.....	1,000	45	10,000
Vegetables.....crates..	200,000	6,000	200,000
Sirup.....gallons..	3,000	16	1,500
Furs:			
Otter.....number..	1,500	1	9,000
Coon.....do.....	5,000	.6	1,500
Hides:			
Alligator.....do.....	60,000	180	42,000
Cow.....do.....	700	14	1,900
Deer.....do.....	2,000	1.5	600
<i>Receipts at Myers.</i>			
Merchandise (groceries, dry goods, hardware, grain, etc.).....		1,000	300,000
Fertilizers.....		860	30,100
Hay.....		200	4,200
Horses.....number..	100	60	12,500
<b>Total shipments and receipts.....</b>		<b>8,963.6</b>	<b>642,610</b>

In 1897, the year previous to the date of the above tabulated statistics, there was shipped from Myers 24,000 boxes of oranges and 1,500 of grape fruit. It is believed that there will be 40,000 boxes of oranges and 3,000 boxes of grape fruit this year.

*Shipments from Puntarasa.*

Items.	Quantity.	Weight in tons.	Designated value.
Cattle.....number..	21,000	3,150	\$232,000
Hogs.....do.....	4,000	120	20,000
Vegetables.....crates..	10,000	300	15,000
Farming supplies, fertilizers, etc.....		500	6,000
<b>Total shipments and receipts.....</b>		<b>3,620</b>	<b>293,000</b>

The commercial statistics in the foregoing tables were kindly furnished by the following gentlemen:

Messrs. W. B. Makinson, C. A. Carson, J. W. Watson, and L. D. Graham of Kissimmee; Mr. Joe Pierce, of Bassinger; Mr. George Hendry, of Labelle; Mr. G. S. Henderson, of Denand; Mr. B. S. Clay, of Auya; Mr. Henry Hertman and Mr. R. A. Henderson, of Myers; and Mr. G. R. Shultz, of Puntarasa.

#### DIVISION 7. IMPROVEMENTS AND SURVEY.

Parties interested were interviewed along the route. Those living in the Kissimmee Valley are unanimously in favor of improvements that will afford navigation throughout the year from Kissimmee to Bassinger. They ask for a channel 36 inches deep (at low water) and 30 feet wide. The residents of the Caloosahatchee Valley are in favor of a continuation of the excellent improvements inaugurated October 16, 1883. (See Report of the Chief of Engineers for 1884, Part II, p. 1195.) A preliminary examination of this river was made from Lake Okechobee to the Gulf of Mexico in March and April, 1879. (See Report of the Chief of Engineers for 1879, Part I, p. 863.) A complete survey of the river was made by Assistant Engineer J. W. Sackett, under the direction of Capt. W. M. Black, Corps of Engineers, U. S. A., in March, April, and May, 1887. (See Report of the Chief of Engineers for 1888, Part II, p. 1095.) Some of the residents along the lower Caloosahatchee and around San Carlos Bay are advocates of a deeper channel at the Gulf entrance.

Some citizens are in favor of improving the entire water route from Kissimmee to the Gulf. Others are opposed to it: (1) Some in the Kissimmee Valley fear that if the channel was improved throughout it would lower the upper lakes so much as to impede rather than aid navigation; (2) those in the Caloosahatchee Valley fear their lands might be injured by the overflows from an increased volume of water. The canals and cut-offs mentioned throughout this report were dredged under the laws of the State of Florida by the Atlantic and Gulf Coast Canal and Okechobee Land Company. The work was done with an intention of draining the Okechobee basin. Indirectly it was a benefit to navigation, for the entire channel is used by steamers at irregular intervals.

I am of the opinion that the commercial interests involved are such as to justify the General Government in improving the Kissimmee River, lakes, and canals from the town of Kissimmee to the warehouse landing near the village of Bassinger. I recommend that a survey of these waters be made, and that it include the lower Kissimmee to Okechobee, and the Istokpoga Creek from Lake Istokpoga to the Kissimmee River. The channel route to be surveyed is 198 miles long, consisting of 155 miles of river, 34½ miles of lake channel, and 8½ miles of canal. The survey would cost about \$4,000.

The improvements desired on the Caloosahatchee are really maintenance of the completed project, and can be accomplished with the current appropriation for that river.

The only interests demanding a through route from the Caloosahatchee to the Kissimmee are tourists, but such travel is too insignificant to be worthy of consideration.

I am of the opinion that the entrance to San Carlos Bay is sufficiently deep for the present needs of commerce. If the wonderful prosperity of Lee and De Soto counties continues, the time may come when larger vessels, seeking that carrying trade, will require a deeper channel.

In conclusion of this report, I wish to acknowledge the cheerful and energetic assistance rendered me by Mr. William P. Jervey. Also, both he and I are indebted to Capt. R. A. Hendry, state representative of Lee County; Captain Menge, master of the steamer *Gray Eagle*; Captain Fisher, master of the *St. Lucie*; and Capt. Clay Johnson, master of the *Roseada*, for valuable information and hospitable courtesies. Captain Johnson, who is thoroughly familiar with the route from Kissimmee to Meyers, was untiring in his zeal, and rendered us all needed assistance.

Very respectfully,

W. H. CALDWELL,  
*Assistant Engineer.*

Capt. HENRY JERVEY,  
*Corps of Engineers, U. S. Army.*

SURVEY OF KISSIMMEE RIVER, FLORIDA, FROM KISSIMMEE TO LAKE  
OKECHOBEE, AND OF ISTOKPOGA CREEK.UNITED STATES ENGINEER OFFICE,  
*Tampa, Fla., December 14, 1901.*

GENERAL: 1. I have the honor to submit the following report of a survey of the Kissimmee River and connecting lakes and canals flowing into Lake Okechobee, made in accordance with the provisions of the river and harbor act of March 3, 1899. The act provided for a preliminary examination of the above waterways and the Caloosahatchee River to the Gulf of Mexico. This preliminary examination was made in August, 1899, by Mr. W. H. Caldwell, assistant engineer, and was reported on by Capt. Henry Jervey, Corps of Engineers, August 23, 1899.

2. The preliminary examination showed that the waterways could be discussed most clearly in three parts: (1) The part between the town of Kissimmee, situated at the headwaters of the Kissimmee River, and Fort Bassinger, situated on the river 37.5 miles north of Lake Okechobee; (2) the part between Fort Bassinger and Fort Thompson, situated on the Caloosahatchee River, 23 miles west of Lake Okechobee; (3) the part between Fort Thompson and the Gulf of Mexico. It was found that the third part had already been improved by the United States to a degree sufficient for the existing needs of commerce, and that the second part lay mostly through an uninhabited swamp, and that there was no demand for its improvement except for the benefit of an occasional tourist party. The part between Kissimmee and Fort Bassinger was reported worthy of improvement.

3. With a view to securing complete data for the Kissimmee River, Captain Jervey recommended that a survey be made of the entire river from Kissimmee to Lake Okechobee. This was approved, and the survey was ordered by the Chief of Engineers on September 16, 1899. Owing to the fact that a survey is practicable only during a low stage of the river, which occurs ordinarily during the dry winter season, and to the fact that during the winter of 1899-1900 the water did not fall sufficiently low, the survey was deferred until last winter. The field work was done between January 22 and April 24, 1901, by Mr. Caldwell, to whose report, appended hereto, attention is respectfully invited.

4. The survey covered the river from Kissimmee to Lake Okechobee, a distance of 137 miles, and Istokpoga Creek, 9.4 miles long, connecting Lake Istokpoga with the river 10.5 miles north of Bassinger. Of the 137 miles of waterway between Kissimmee and Lake Okechobee, 97.1 miles consist of natural river channel, 7.5 miles of artificial canals and cut-offs, and 32.4 miles of lakes. No difficulty resulting from insufficient depth is found in navigating the lakes and the river proper. There are many difficult bends in the river, but the commerce does not justify the making of cut-offs. The worst shoals are found in Southport and Kissimmee canals, six in the former and one in the latter.

5. The commerce of the river is carried on with boats of light draft, which bring out the products of the valley along the river and carry back the supplies for the inhabitants. One of the great industries is cattle raising. Most of the cattle are not shipped by the river, but are driven to a port on the Gulf of Mexico. The volume of the commerce

of the river for the past year is stated as follows by parties in Kissimmee:

Oranges.....	boxes..	20,000
Vegetables, wool, hides, etc.....	tons..	150
Cattle, live stock.....	do.....	375
Lumber, shingles, wire-crate material, general merchandise.....	do.....	1,500
Fish, ice, etc.....	do.....	50
Other items.....	do.....	250
Passengers.....	number..	1,000

The prospective increase in commerce is considerable on account of the large amount of pine and cypress timber in the region and the area of land suitable for the cultivation of vegetables, oranges, and other fruits, and for the raising of cattle. The facts are well stated by Captain Jervey in his report of the preliminary examination, as follows:

The territory tributary to this water route comprises about 2,500 square miles. It is essentially a cattle country, the mild climate, abundant pasturage, and almost unlimited ranges reducing the cost of raising to a low figure. Orange culture has reached considerable proportions also, and is on the increase. The railroads that parallel this valley on the east and west are from 30 to 50 miles distant, and the cross-country roads are few and swampy, sometimes impassable. They are used only by mail riders, as all supplies are drawn from Kissimmee, being carried on wagons when low water stops navigation.

6. The channel desired by the navigation and commercial interests is one 30 feet wide and at least 3 feet deep at ordinary stage of river, which is rather an elastic term, meaning the stage existing for several months during the middle of the dry season and admitting of no closer definition than that it is a stage about 1 foot above the lowest known stage of the river. To secure this channel it will be necessary to dredge 31,130 cubic yards of material in Southport Canal and 6,153 cubic yards in Kissimmee Canal. Four bulkheads are necessary in Southport Canal, one on each side at the upper end, to prevent sand from being moved into it by wave action, one double bulkhead on west side about midway of the canal to support dredged material, and one sheet-piling bulkhead on the east side near the lower end to preserve the alignment of the channel.

7. The channels to be dredged must be kept as narrow as possible in order to avoid causing the water of the river to run off more rapidly during the dry season than it does already, thereby draining the sources of supply. With this in view, the cuts will be limited to a width of 30 feet and the dredged material will as far as possible be so disposed as to restrict the flow during low stages to the 30-foot channel.

8. Istokpoga Creek is a short stream, the outlet of the lake of the same name. Its navigation is obstructed chiefly by four small shoals and by a large number of snags and overhanging trees. Steamers formerly ran up this creek, but have ceased to do so on account of the difficulties of navigation. There are a few settlements on the creek and lake, and it is believed that if the creek were improved a large increase in population and commerce would result on account of the desirable agricultural land and cypress timber to be found in the vicinity.

9. The unit prices of work in these waters will be high because of their distance from centers of business. The cost of dredging in Istokpoga Creek has been placed especially high on account of the fact that to take a dredge there and return will cost a great deal more than the actual work of excavation.



10. The estimated cost of the improvements proposed is as follows:

Southport Canal, dredging 31,130 cubic yards, at 30 cents .....	\$9,339.00
Kissimmee Canal, dredging 6,153 cubic yards, at 30 cents .....	1,845.90
Southport Canal:	
Bulkhead, east side upper end .....	850.00
Bulkhead, west side upper end .....	1,005.00
Bulkhead, west side midway of canal .....	5,920.00
Bulkhead, east side lower end .....	460.00
Engineering and contingencies .....	2,900.00
<b>Total for Kissimmee River and connections .....</b>	<b>22,319.90</b>
Istokpoga Creek:	
Dredging 332 cubic yards, at \$1.50 .....	498.00
Removing 50 snags, at \$5 .....	250.00
Trimming 602 trees, at \$1.50 .....	903.00
Engineering and contingencies .....	250.00
<b>Total .....</b>	<b>1,901.00</b>
<b>Total for whole improvement .....</b>	<b>24,220.90</b>

11. It is believed that the expenditure of the above sum is justified by the interests involved, and the improvement is therefore recommended.

12. Fifteen tracings showing the results of the survey are forwarded herewith.

Very respectfully, your obedient servant,

HERBERT DEAKYNE,  
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILESPIE,  
*Chief of Engineers, U. S. A.*  
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,  
*Baltimore, Md., December 23, 1901.*

1. Respectfully submitted to the Chief of Engineers, United States Army.

2. The level of Lake Tohopekaliga is about 45 feet above the level of Lake Okechobee, the latter being about 20½ feet above the level of the sea. The fall from the former to Lake Okechobee is concentrated chiefly in short sections of the canals connecting the lakes, and in the Kissimmee River. A 3-foot navigation is all that is contemplated, but it is evident that any increase in the dimensions of the canals or channels connecting the lakes will tend to drain off the water and lower the pool above. The district engineer is of the opinion that the small increased cross section which he proposes will not cause a large increase in the outflow. He therefore proposes to limit the width of the cut to 30 feet.

3. The survey does not disclose the sources of water supply to Lake Tohopekaliga. As the maps do not indicate any streams of consequence entering into the lake, it is supposed that the principal water supply must be from rain falling directly on the lake and a comparatively small watershed.

4. I doubt very much whether the small quantity of work estimated for will be of any material benefit, but as the project calls

for a very small appropriation the improvement is recommended as worthy of being undertaken by the Government to the extent of the amount estimated.

PETER C. HAINS,  
Colonel, Corps of Engineers,  
Division Engineer, Southeast Division.

REPORT OF MR. W. H. CALDWELL, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,  
Tampa, Fla., November 30, 1901.

CAPTAIN: I have the honor to submit the following report of survey of Kissimmee River and connecting lakes and canals flowing into Lake Okechobee. The survey was made under verbal instructions given me by your predecessor, Capt. Thos. H. Rees, Corps of Engineers, U. S. Army.

The surveying party consisted of 1 transit man, 2 recorders, 2 rodmen, 1 master of steamboat, 1 steamboat engineer, 1 boatman, 1 cook, and myself. The party left Tampa January 21, 1901, and boarded the steamer *Roseada* at Kissimmee. Field work of the survey actually began the following day. The *Roseada* is a light-draft stern-wheel steamer and was chartered for a quarter boat during the survey. Field work was completed April 24, 1901, and the surveying party returned to Tampa that evening.

(1) WATERWAY, AREAS, AND DISTANCES.

The waterway surveyed extends from Lake Tohopekaliga to Lake Okechobee, including Istokpoga Creek—the largest affluent of the Kissimmee River. The town of Kissimmee is on the northwestern shore of Lake Tohopekaliga. The southern end of that lake is connected with Cypress Lake by Southport Canal. The navigable water leading from the latter lake into Lake Hatcheneha is Hatcheneha Canal. The two lakes (Cypress and Hatcheneha, are also connected by Kissimmee River, which lies westward of the canal. Lake Hatcheneha is connected with Lake Kissimmee by the Kissimmee River. Lower part of the river is not navigable. Steamboats use the Kissimmee Canal, which leaves the river 0.2 mile below Fort Gardner and connects with the lake westward of the river. Lake Kissimmee is connected with Lake Okechobee by the Kissimmee River. Istokpoga Creek empties into Kissimmee River from the westward 47 miles below Lake Kissimmee.

The area of Lake Tohopekaliga is 32 square miles; of Cypress Lake, 6 square miles; of Lake Hatcheneha, 10 square miles, and of Lake Kissimmee, 61 square miles.

Length of Southport Canal is 3.8 miles; of Hatcheneha Canal, 2.4 miles; of Kissimmee River, from Lake Hatcheneha to upper end of Kissimmee Canal, 2.1 miles; of Kissimmee Canal, 1.3 miles; of Kissimmee River, from Lake Kissimmee to Lake Okechobee, 95 miles, and of Istokpoga Creek, from its junction with the Kissimmee River to Lake Istokpoga, 9.4 miles.

Distances from the town wharf at Kissimmee to landings or other points along the route are tabulated below:

From—	To—	Statute miles.	Remarks.
Town of Kissimmee.....	Upper end of Southport Canal.	10.8	Distance measured on course passing eastward of Paradise Island.
Do.....	Lower end of Southport Canal..	14.6	Distance across Cypress Lake measured on a direct course between Southport and Hatcheneha canals.
Do.....	Upper end of Hatcheneha Canal	16.4	
Do.....	Lower end of Hatcheneha Canal	18.8	
Do.....	Kissimmee River entrance, southeast end of Lake Hatcheneha.	22.3	
Do.....	Tatmans Landing.....	22.5	
Do.....	West Gardner Landing.....	23.5	
Do.....	East Gardner Landing.....	23.9	
Do.....	Fort Gardner Landing.....	24.2	
Do.....	Upper end of Kissimmee Canal.	24.4	
Do.....	Lower end of Kissimmee Canal.	25.7	

From—	To—	Statute miles.	Remarks.
Town of Kissimmee.....	Grape Hammock Landing, south end of Lake Kissimmee, west side.	39.2	
Do.....	Turkey Hammock Landing, south end of Lake Kissimmee, east side.	40.4	
Do.....	Kissimmee River entrance, south end of Lake Kissimmee.	42.0	Distance measured on direct course passing eastward of Brahma Island.
Do.....	Long Hammock Landing.....	45.3	
Do.....	R. Godwin's Landing.....	50.7	
Do.....	East end of ditch leading to E. Godwin's warehouse.	52.7	
Do.....	Cabbage Bluff Landing.....	54.3	
Do.....	Alligator Bluff Landing.....	56.5	
Do.....	Orange Hammock Landing.....	59.3	
Do.....	Fort Kissimmee Landing.....	64.0	
Do.....	Upper end of Joe Guy Cut-off.....	65.9	
Do.....	Lower end of Joe Guy Cut-off.....	66.6	
Do.....	McLaughlins Landing.....	70.8	
Do.....	Bluff Hammock Landing.....	78.8	
Do.....	Hole-in-the-Wall.....	80.1	
Do.....	Upper end of Turtle Mound Cut-off.	82.6	
Do.....	Lower end of Turtle Mound Cut-off.	82.7	
Do.....	Micos Landing.....	87.2	
Do.....	Mouth of Istokpoga Creek.....	89.0	
Do.....	Upper end of Bumblebee Cut-off.	91.5	
Do.....	Lower end of Bumblebee Cut-off.	92.7	
Do.....	Upper end of Jack Scarborough Cut-off.	93.1	
Do.....	Lower end of Jack Scarborough Cut-off.	94.0	
Do.....	Laniers Landing.....	95.6	
Do.....	Warehouse at proposed new landing for Bussinger.	97.4	
Do.....	Bussinger Landing.....	99.5	
Do.....	Mrs. J. M. Pierce's Landing.....	100.2	
Do.....	Loftons Landing.....	102.7	
Do.....	Peebles Landing.....	104.8	
Do.....	Lambs Landing.....	105.1	
Do.....	Jake Morgan's Landing.....	108.7	
Do.....	Platts Bluff Landing.....	112.4	
Do.....	Wolf Island Bluff Landing.....	118.7	
Do.....	Wood Landing—opposite big maple tree.	136.0	This landing is on right bank of river 1 mile above Lake Okechobee.
Do.....	Lake Okechobee.....	137.0	

(2) SURVEY OF THE LAKES.

The upper portion of Lake Tohopekaliga was triangulated, the system extending as far south as Flemings Island. A base line was measured at the town of Kissimmee, on the mall that is situated eastward of the S., E. and W. Railway depot. The base was measured with a steel tape 100 feet long, supported on the ground throughout its length and a pull of 12 pounds exerted on the tape at every measurement of 100 feet. Three measurements of the base line were made. Its mean length is 2,200.043 feet, with a probable error of about 1 in 110,000.

The system of triangulation could not be extended southward of Flemings Island because the telescopes of the transits at hand were not of sufficient power to see triangulation stations across that portion of the lake. Perhaps the observations might have been obtained had the weather and other conditions been more favorable. During the survey of Tohopekaliga the atmosphere was hazy mornings and evenings, and a heavy smoke overhung the lake constantly, it being the season when cattlemen were firing the surrounding prairies.

The shore line of that portion of the lake not triangulated, as well as the stretches between the triangulation stations, was run in with transit and stadia.

A system of triangulation was extended over the whole area of Cypress Lake, with a base line on the northeastern shore. The base was measured with a 100-foot steel tape, supported on the ground throughout its length, and a pull of 12 pounds exerted on the tape at every measurement. The base line was measured twice. The mean length is 3,200.01 feet, with a probable error of about 1 in 475,000.

The shore line between the triangulation stations, except a portion on northern side of the lake adjacent to entrance of Southport Canal, was run in with transit and stadia. On both sides of this canal entrance is a deep marsh. From boats flagstakes were set at points along edge of the marsh. A secondary base line, 1,000 feet long, was measured on dry ground at western bank of the canal. The base is nearly perpendicular to the shore line. From its extremities angles were read to the flagstakes, and their locations thence determined.

A system of triangulation was devised to cover the whole area of Lake Hatcheneha. The base line is broken, the two measured sides having termini on the southeastern shore of the lake's northern arm, but the greater portion of either side extends across shoal waters. The sides were measured with a 100-foot steel tape, supported on stakes 100 feet apart driven level with the lake surface, and a pull of 18 pounds exerted on the tape at every measurement. The base was measured but once, on account of the water through which it was necessary to wade being very cold and the consequent apprehension that members of the surveying party might become sick.

The angle between the two sides was observed, and the broken base was reduced to a straight line.

The eastern shore of the lake and portions of its northern and southern shores were run in with transit and stadia. The remainder of the shore line, where the marshes and open water of the lake meet, was determined by secondary triangulation.

Nearly all of Lake Kissimmee was triangulated, the base line of the system being on the western shore, south of Kissimmee Canal entrance. A portion of the western area of the lake in the vicinity of Brahma Island was not triangulated; the transit telescopes were of insufficient power to see across the lake at that point. The base was measured with a 100-foot steel tape, supported throughout its length on the ground, and a pull of 12 pounds exerted on the tape during every measurement. The base was measured twice. The mean length is 2,449.98 feet, with a probable error of about 1 in 180,000.

The larger portion of the eastern shore, and some of the western shore, were run in with transit and stadia between the triangulation stations. The remainder of the shore line, where the marshes and open water of the lake meet, was determined by secondary triangulation.

Points on the islands in Lake Kissimmee were established by triangulation from the nearest shore stations. The islands were circuit with transit and stadia from the established points.

### (3) MAGNETIC VARIATION.

The magnetic variation of the needle was determined at three places, each being approximately in the middle of a zone covering one-third of the total area of survey. The places of observation, methods used, variation determined, and dates are tabulated below:

Place.	Methods.	Variation.	Date.
Bank on east side of Southport Canal, northern shore of Cypress Lake.	Azimuth of * Polaris at west elongation.	1 31 18 E.	1901. Feb. 6
Prairie on left bank of Kissimmee River at Alligator Bluff Landing.	Equal altitudes of ☉.....	2 02 00 E.	Mar. 7
Left bank of Kissimmee River at Wolf Island Bluff Landing.	Azimuth of * Polaris at west elongation.	1 50 54 E.	Mar. 28

The variation used for plating the lake and canal charts was 1° 31' E.; for Kissimmee River from Lake Kissimmee to Bassinger Landing, 2° 02' E.; for Istokpoga Creek, 2° 02' E.; and for Kissimmee River from Bassinger Landing to Lake Okecho-bee, 1° 51' E.

### (4) SURVEY OF THE CANALS, RIVER, AND CREEK.

The connecting waterways between the upper lakes, namely, Southport Canal, Hatcheneha Canal, and Kissimmee River, and Kissimmee Canal, were surveyed with transit and stadia. The stadia stations at end of each were tied to a triangulation or stadia station of the adjacent lake's survey.

Beginning at the triangulation station farthest south in Lake Kissimmee a transit and stadia survey was made of Kissimmee River to its mouth at Lake Okecho-bee.

From the stadia station on Kissimmee River nearest the mouth of Istokpoga Creek a transit and stadia survey was made to the creek's source at Lake Istokpoga.

(5) DIFFERENTIAL LEVELING.

Lines of levels were run along the waterways between the lakes, from which the elevations (above the level of Lake Okechobee) of the bench marks and turning points were deduced. The elevation of Lake Okechobee above the mean low-water level of the Gulf of Mexico was determined from a bench mark on west side of the lake at head of Okechobee Canal. This bench mark was established by a United States Engineers' surveying party in 1887. Having found the elevation of Lake Okechobee above the Gulf of Mexico, the elevation of bench marks and stations of the Kissimmee River survey were reduced to the same datum plane.

Elevations on April 2, 1901, of the lake surfaces and of three places on the Kissimmee River are given in the following table:

Name.	Height above mean low-water level of Gulf of Mexico.
	<i>Feet.</i>
Lake Okechobee .....	20.42
Kissimmee River, at Bassinger Landing .....	35.08
Kissimmee River, at mouth of Istokpoga Creek .....	41.21
Source of Istokpoga Creek, Lake Istokpoga .....	49.03
Kissimmee River, at Fort Kissimmee Landing .....	51.63
Lake Kissimmee .....	60.28
Lake Hatcheneha .....	62.30
Cypress Lake .....	63.45
Lake Tohopekaliga .....	65.26

(6) BENCH MARKS AND GAUGES.

Bench marks were established at both ends of the several canals, at the source and mouth of Kissimmee River and of Istokpoga Creek. Bench marks were also established on the lakes' shores and along the river course, and the water surface referenced to them by very careful leveling.

Staff gauges, divided into feet and tenths, were established in the lakes, canals, river, and creek. A gauge was always kept near the particular field of work. The gauges were set with their zeros about one foot below the ordinary level of the water course surface. The first gauge established was at the town wharf in Kissimmee. The next one had its zero secured at the same level below surface of water by simultaneous readings of the two gauges.

In this manner each gauge was set with its zero the same depth below the water surface as the one established last preceding it.

The location and description of all bench marks are given in the following table:

*Bench marks.*

Place.	Description.	Elevation above datum plane.	Elevation above adjacent water surface, and date.
Outer end of Kissimmee town wharf, Lake Tohopekaliga.	Horizontal row of 5 wire nails on south face of a pile under northwest corner of bath house at outer end of town wharf.	<i>Feet.</i> 70.68	4 feet, Jan. 21.
Northerly side of Stewart street, 50 feet east of S., E. and W. Rwy., Kissimmee, Fla.	Top of 3-inch iron pipe, 3 feet long, driven 2 feet 8 inches into ground. Pipe is 4 feet north 50° 31' east true, from $\Delta$ A of Lake Tohopekaliga survey.	72.11	5.46 feet, Jan. 21.
Upper end of Southport Canal.	Top of 3-inch iron pipe, 1.5 feet long, driven flush with earth. Pipe is on high ground near Jim Zaunbitz's wagon gate, about 20 feet east of canal edge. Pipe is opposite to inshore end of row of piles standing along west edge of canal.	72.35	5.57 feet, Jan. 31.

## Beach marks - Continued.

Place	Description.	Elevation above datum plane.	Elevation above adjacent water surface, and date.
North shore of Cypress Lake, near Southport Canal entrance.	Top of 3-inch iron pipe, 1.5 feet long, driven flush with earth. Pipe is on west side of Southport Canal entrance, about 50 feet from edge of lake.	<i>Fcft.</i> 65.36	0.99 foot, Feb. 4.
Lower end of Presidents Cut, 1.4 miles from upper end of Hatcheneha Canal.	Top of 3-inch iron pipe, 1.5 feet long, driven 14 inches into the earth. Pipe is on crest of embankment, east side of canal, 10 feet from edge of water.	67.07	4.86 feet, Feb. 8.
East shore, Lake Hatcheneha.	Top of 1.5-inch iron pipe, 1.5 feet long, driven 17 inches into the earth. Pipe is in a clump of cypress trees on the most southern dry point of land on east shore. Three cypress trees, 10 feet from pipe, are blazed on sides facing it.	63.62	0.74 foot, Feb. 18.
Kissimmee River, near upper end of Kissimmee Canal.	Horizontal row of 4 wire nails driven into northwest face of small oak tree that stands on high bank west side of upper end of Kissimmee Canal.	67.04	5.34 feet, Feb. 16.
Northeast extremity of peninsula between Tiger Creek Cove and Kissimmee Canal entrance.	7 wire nails in a horizontal row driven into northerly face of oak tree at northeast edge of woods. The 3 central nails are close together and protrude 1 1/2 inches. Others were driven flush with a space of 2 inches between them.	64.52	3.89 feet, Feb. 20.
Northeast end of Brahma Island, Lake Kissimmee.	Top of 1.5-inch iron pipe, 18 inches long, driven level with earth. The pipe was set 15 feet from edge of lake where there are neither trees nor grass.	60.80	0.27 foot, Feb. 26.
R. Godwin's Landing, left bank of Kissimmee River.	Line between 2 horizontal rows of 4 wire nails driven flush in corner plank of north side of Mr. Godwin's warehouse.	61.88	4.65 feet, Mar. 5.
Corner post of warehouse at Cabbage Bluff Landing, right bank of Kissimmee River.	A horizontal row of 5 wire nails driven into north face of southeast corner post of Jack Whidden's warehouse. Heads of the nails are bent over and down against the post.	59.73	3.98 feet, Mar. 5.
Warehouse at Alligator Bluff Landing, left bank of Kissimmee River.	Line between two horizontal rows of four nails driven into outside face of sill post at northwest corner of warehouse. The lower nails are turned down against the sill.	59.95	5.34 feet, Mar. 6.
Large oak tree at Orange Hammock Landing, right bank of Kissimmee River.	A horizontal row of five wire nails driven into north face of tree about 2 feet above the ground. The nails protrude 1 inch.	60.33	6.72 feet, Mar. 8.
Dead oak tree at Fort Kissimmee Landing, right bank of Kissimmee River.	A horizontal row of five wire nails driven into southeast face of dead oak about 4 feet from ground. Tree stands in a field and is 150 feet from river.	60.60	8.81 feet, Mar. 9.
Lower end of Turtle Mound Cut-off, right bank of Kissimmee River.	Top of 3-inch iron pipe, 18 inches long, driven 14 inches into earth. Pipe stands on narrow bank ridge that was 1 foot above river surface on Mar. 15, 1901. A 2 by 4 inch scantling, projecting 10 inches above ground, is just south of the iron pipe.	45.83	1.31 feet, Mar. 15.
Oak tree at Micos Landing, left bank of Kissimmee River.	A horizontal row of four wire nails driven in northwest face of an oak tree that stands about 20 feet from edge of river. Nails are about 2 feet above ground and 1 inch apart. Facing the row left nail protrudes 1 inch, right one 1/2 inch, and middle two were driven flush with wood.	48.26	6.01 feet, Mar. 16.
Twin willow near upper end of Jack Scarborough Cut-off, left bank of Kissimmee River.	Three wire nails in horizontal row driven flush on north side of a twin willow tree. Nails are just above the ground. Willow stands at edge of river.	42.61	4.99 feet, Mar. 18.
Warehouse at Laniers Landing, right bank of Kissimmee River.	Five wire nails in horizontal row on west side of warehouse, 6 inches from ground.	42.32	5.66 feet, Mar. 19.

## Bench marks—Continued.

Place.	Description.	Elevation above datum plane.	Elevation above adjacent water surface, and date.
Cabbage palmetto at Landers Landing, right bank of Kissimmee River.	Four wire nails in horizontal row on north face of cabbage palmetto, driven flush, about 12 inches from ground. Tree stands about 50 feet west of warehouse, and 20 feet south from edge of river.	<i>Fect.</i> 41.56	4.50 feet, Mar. 19.
Warehouse at proposed new Bassinger Landing, left bank of Kissimmee River.	Five nails in a horizontal row driven flush on north side of northwest sill post of warehouse at a height of 3.3 feet from ground.	39.98	3.83 feet, Mar. 19.
Tree on left bank 2.1 miles below Platts Bluff Landing, Kissimmee River.	Single wire nail driven into willow. Nail protrudes $\frac{1}{2}$ inch. Willow is blazed on southeast side; it stands on edge of bank and overhangs the river.	30.41	0.49 foot, Mar. 24.
Cabbage palmetto on left bank at Wolf Island Bluff Landing, Kissimmee River.	Five nails in a horizontal row, $\frac{1}{2}$ inch apart, driven in a step 3 feet from ground on west side of a palmetto nearest the river's edge. Middle nail was driven flush; others protrude $\frac{1}{2}$ inch.	32.23	4.36 feet, Mar. 24.
Big maple tree on left bank opposite wood landing, 1 mile above Lake Okechobee, Kissimmee River.	Five wire nails in horizontal row driven in blazed space on north face of maple tree. All except middle nail protrude $\frac{1}{2}$ inch.	25.40	4.44 feet, Apr. 1.
Cypress tree on right edge of Istokpoga Creek, near Lake Istokpoga.	Five wire nails in a horizontal row driven in step cut on northwest face of tree. Middle nail was driven flush; one on either side protrudes $\frac{1}{2}$ inch; and the two outer ones protrude $\frac{1}{2}$ inch.	33.34	5.11 feet, Apr. 11.

## (7) SOUNDINGS AND BORINGS.

Soundings were taken with wooden rods, graduated to feet and tenths. No attempt was made to sound the whole area of the lakes, there being ample depths in them to meet the requirements of navigation. Lines of soundings were run between certain triangulation stations and along the routes usually followed by the Kissimmee steamers. In Lake Tohopekaliga, north of Paradise Island, a shoal was developed by soundings across it.

A mid-channel line of soundings was obtained in the canals, and soundings across the channels were taken at the shoal places. The entrances at upper and lower ends of Southport Canal and at lower end of Kissimmee Canal are very shoal. Sufficient soundings were taken across the shoals to develop their contours.

In Kissimmee River and Istokpoga Creek mid-channel lines of soundings were obtained; also a cross-channel line of soundings was taken about every half mile of the channel course.

Character of the bottom was obtained and recorded whenever soundings were taken. Borings were made in the shoal areas of the canals. To a depth of 6 feet below the ordinary stage of the canals fine white sand underlaid by hardpan was found in Southport Canal, coarse sand and mud in Hatcheneha Canal, and fine white sand in Kissimmee Canal.

## (8) DISCHARGE OF STREAMS.

Gaugings of the flow of the streams were made above the inlets and below the outlets of the lakes and at intermediate points where conditions were especially favorable for the purpose. On the Kissimmee River between Lake Kissimmee and Lake Okechobee the actual gaugings were made some distance from the lakes, in order that advantage might be taken of straight reaches where the banks are parallel and the channel uniform in cross section.

Double floats were used to obtain the velocity of the current. The lower float was immersed nine-tenths depth of channel. Minimum distance between any set ranges was 200 feet; the maximum, 500 feet. Cross sections were taken at intervals of 50 feet along the gauged length. The floats were started in mid-channel 100 feet above the upper range, and the spaces between them at the starting point did not exceed 20 feet.

The slopes of the water surface between the upper and lower ends of the gauged portions were accurately determined.

The character and material of banks and bottom were noted.

Two gaugings at the same point were made at different stages of the stream wherever practicable. In fact, it was done at every point except at the lower end of the Kissimmee River and on Istokpoga Creek. Those two points were gauged just before conclusion of the survey. To have obtained a second gauging of them necessitated waiting for a change of stage, and that involved more expense than the survey funds would allow.

Results of the gaugings are embodied in the following table:

Gaugings.

Place where gauging was made.	Date.	Stage of stream.	Character and material of banks.	Character and material of bottom.	Distance of extreme ranges.			
					Feet.	Slope of water surface between extreme ranges.	Average velocity of stream per second.	Volume of discharge per second.
Upper end of Southport Canal.	1901. Feb. 2	Ordinary .....	High, 8-10 feet; fine sand.	Hard sand; mud near lower range.	250	0.043	0.9150	328.9
	Do.....	Apr. 23	Low: 1.04 feet below stage of Feb. 2.	High, 9-11 feet; fine sand.	.....do.....	250	0.011	0.6290
Lower end of Southport Canal.	Feb. 4	Ordinary .....	Right bank, firm mud and sand; left bank, black soft mud. Elevation above water, 0.4-1.6 feet.	Black mud...	250	0.038	1.4910	291.3
	Do.....	Apr. 23	Low: 1.04 feet below stage of Feb. 4.	Right bank, firm mud and sand; left bank, firm black mud. Elevation above water, 1.4-2.6 feet.	.....do.....	250	0.008	1.3780
Upper end of Hatcheneha Canal.	Feb. 8	Ordinary .....	Stiff mud. Elevation above water, 1.7-4.6 feet.	Sticky mud...	300	0.037	0.9786	803.9
	Do.....	Apr. 22	Low: 1.3 feet below stage of Feb. 8.	Stiff mud. Elevation above water, 3-5.9 feet.	.....do.....	300	0.011	0.9448
Lower end of Hatcheneha Canal.	Feb. 9	Ordinary .....	Right bank, soft mud; left bank, marsh. Elevation above water, 0.0-2.1 feet.	Very soft mud.	300	0.044	1.0966	245.8
	Do.....	Apr. 22	Low: 1.3 feet below stage of Feb. 9.	Right bank, firm black mud; left bank, soft mud. Elevation above water, 1.3-3.4 feet.	.....do.....	300	0.012	0.9657
Kissimmee River (just below Lake Hatcheneha) near Shell Hammock Cut-Off.	Feb. 19	Ordinary .....	Right bank, marsh; left bank, stiff mud and clay.	Hard mud or clay.	200	0.012	1.2198	655.9
	Do.....	Apr. 18	Low: 0.9 foot below stage of Feb. 19.	.....do.....	.....do.....	200	0.006	0.7757
Kissimmee River, near upper end of Kissimmee Canal.	Feb. 19	Ordinary .....	Right bank, firm mud and sand; left bank, soft mud. Elevation above water, 0.0-1.6 feet.	Mud and sand	300	0.043	1.3421	598.2



Gaugings—Continued.

Place where gauging was made.	Date.	Stage of stream.	Character and material of banks.	Character and material of bottom.	Distance of extreme ranges.		Average velocity of stream per second.	Volume of discharge per second.
					Feet.	Feet.		
Kissimmee River, near upper end of Kissimmee Canal.	1891. Apr. 18	Low: 0.9 foot below stage of Feb. 19.	Right bank, firm mud and sand; left bank, firm mud. Elevation above water, 0.9-2.5 feet.	Mud and sand	300	0.016	0.8228	290.6
Lower end of Kissimmee Canal.	Feb. 17	Ordinary	Fine white sand. Elevation above water, 0.7-8.4 feet.	Hard sand	300	0.063	1.2758	223.2
Do.....	Apr. 18	Low: 0.9 foot below stage of Feb. 17.	Fine white sand. Elevation above water, 1.6-9.3 feet.	.....do.....	300	0.019	0.9448	97.3
Upper end of Kissimmee River, near Cabbage Bluff Landing.	Mar. 12	Ordinary	Right bank, stiff black soil; left bank, ridge of sand. Elevation above water, 0.0-2.8 feet.	.....do.....	500	0.028	1.3945	1120.4
Do.....	Apr. 15	Low: 0.5 foot below stage of Mar. 12.	Right bank, stiff black soil; left bank, ridge of sand. Elevation above water, 0.5-3.3 feet.	.....do.....	500	0.030	1.3264	979.4
Lower end of Kissimmee River, near Peoples Landing.	Mar. 23	Low	Right bank, hard earth, with rock at depth of 3 feet; left bank, narrow ridge of sand. Elevation above water, 0.4-2.9 feet.	.....do.....	500	0.029	1.3141	1216.7
Istokpoga Creek, 1 mile below Watdrons Ferry.	Apr. 13	.....do.....	Right bank, marsh; left bank, stiff black soil. Elevation above water, 0.0-2.4 feet.	Hard mud	200	0.083	1.5469	140.2

(9) SNAGS AND OVERHANGING TREES.

Kissimmee River is remarkably free from snags and overhanging trees. None of the overhanging trees are of enough consequence to interfere with navigation. There are 10 snags, located as follows: One near right bank of river, 2.4 miles below mouth of Istokpoga Creek; three near right bank of river, situated 1,650, 1,765, and 2,055 feet, respectively, below Mrs. J. M. Pierce's Landing; one near right bank, 2,600 feet above Jake Morgan's Landing; one near right bank, 8,150 feet below Jake Morgan's Landing, and one near left bank, 8,260 feet below same landing; one near right bank, 2,000 feet below Platts Bluff Landing, one in midstream 3,775 feet below the landing, and one near left bank, 4,400 feet below the same landing.

There are no snags in the canals, and no overhanging trees along them sufficient to interfere with navigation.

There are 50 snags and 602 overhanging trees along Istokpoga Creek. Of the overhanging trees 314 are on the right bank and 288 on the left bank. The creek is 9.4 miles long. The obstructions to navigation begin 1.8 miles above the mouth of the creek and continue at varying intervals from there to Lake Istokpoga.



Estimate for improvement of waterway between the town of Kissimmee and Lake Tohopekaliga and Bassinger Landing on Kissimmee River—Continued.

BULKHEADS.

Place.	Length.	Character.	Cost.
East side Southport Canal, upper entrance.	<i>Feet.</i> 514	Row of 6-inch piling, driven close together. Walling strips on both sides at height of 3 and 6 feet above ordinary stage of water.	\$850.00
West side of Southport Canal, upper entrance.	656	do	1,005.00
West side and about midway between ends of Southport Canal.	2,960	Posts 5 inches diameter, and cap timbers 4 by 4 inch, with 2 by 8 inch sheet piling spiked to cap timbers. Two lines 25 feet apart.	5,920.00
East side and near lower end of Southport Canal.	400	Single line of sheet piling bulkhead, spiked to cap timbers on posts driven 6 feet apart.	460.00
Total			8,235.00

Dredging	\$11,184.90
Building bulkheads	8,235.00
Engineering and contingencies	2,900.00
<b>Total cost of improvement</b>	<b>22,319.90</b>

Estimate for improvement of Istokpoga Creek, the western tributary of Kissimmee River.

DREDGING.

There are four shoals of small area in this stream. The one farthest downstream is 96 feet long; the next, 54 feet; the third, 52 feet; and the last, 50 feet. Width of the proposed sections is 25 feet, and depth, 3 feet. Total material to be removed is 332 cubic yards which, at \$1.50 per yard, will cost \$498.

SNAGS AND OVERHANGING TREES.

Blasting and hoisting out 50 snags, at \$5 each	\$250
Trimming 602 overhanging trees, at \$1.50 each	903
<b>Total</b>	<b>1,153</b>
Dredging	498
Removal of snags and overhanging trees	1,153
Engineering and contingencies	250
<b>Total cost of improvement</b>	<b>1,901</b>

The dredging estimates are based on place measurements. One foot is allowed for backfilling. A slope of 1 on 3 is allowed for both sides of the cuts in Southport and Kissimmee canals. No slope is allowed for the cuts in Istokpoga Creek, because the estimates are based upon dredging to full width of the stream.

The unit price of dredging in Istokpoga Creek is estimated considerably larger than for the canals on account of the small quantity to be dredged and time required to tow a dredge to and from the scene of the work.

Very respectfully,

W. H. CALDWELL,  
Assistant Engineer.

Capt. HERBERT DEAKYNE,  
Corps of Engineers, U. S. Army.